TAMK - University of Applied Sciences Tampere, Finland
Department of Environmental Engineering

FHH – University of Applied Sciences Hannover, Germany
Faculty II – Mechanical Engineering and Biochemical Engineering

Bachelor's Thesis

Copenhagen and Beyond

An Assessment Based on Three Different Approaches to a Post-2012 Climate Framework

Malte Gebler

Supervisors: M.Sc. Mika Nieminen (TAMK)
Prof. Dr.-Ing. Wilfried Stiller (FHH)

Commissioned by: Marjukka Dyer, Head of Dept. of Environmental Engineering, TAMK

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ABSTRACT

Climate change is one of the most crucial issues of the 21st century. The United Nations Framework Convention on Climate Change (UNFCCC), which represents the frame and institution to negotiate climate change-related affairs on the global political level, has decided to make an agreement to address climate change in long-term relations and to define emission reductions for a second Kyoto Protocol commitment period. This agreement should be finalized by the end of 2009 at the fifteenth Conference of Parties, UNFCCC COP 15, in Copenhagen, Denmark. The expectations for this summit were very high and key questions concerning the outcome of this climate change summit can be stated with: What level of emission reduction are developed countries willing to offer? Which role will developing countries, the most vulnerable countries on climate change and the least developed countries play in this agreement? What are the measures taken to enhance sustainable development and who will pay the costs? This Bachelor's Thesis analyses three different approaches to a post-2012 agreement and assesses the COP 15 outcome based on the discussed opinions of climate experts. Finally, this Bachelor's Thesis determines, based on these approaches, if COP 15 changed the City of Copenhagen into "Hopenhagen" or "Brokenhagen" and gives an outlook for future climate change negotiations.

FOREWORD

This Bachelor's Thesis represents an intermediate result of a mental process, which became more concrete and intensive during the autumn periods of the Academic year 2009/10. Based on the lecture series "On the Road to Copenhagen: Climate Change, Development and Gender" at the University of Tampere (UTA), in which different political and social approaches to climate change, development strategies and mitigation options were presented, my personal interest concerning climate related issues emerged and I intensified my studies in these fields.

In spite of the fact that assessments of international conferences do usually not represent a typical topic for a final thesis of an engineering student, I consciously chose this topic to show that a -however designed - multinational binding climate treaty will affect the life of billions directly or indirectly and will additionally influence or change cultural paradigms. Furthermore, referring to the historical determination of an engineer (ancient French term: *engigneor* = a person, who invents and constructs sensuous devices), I'd like to emphasize that scientific, socio-economic and cultural parameters strongly inter-depend with engineering sciences. Therefore this Bachelor's thesis should be considered in context of engineering and its socio-economic and cultural importance – vice versa, a greater understanding in engineering sciences about the direct interconnection with existential problems in natural ecosystems and people's livelihoods (especially in developing countries) is needed.

Those who helped with my studies over the past six months deserve special attention here: M.Sc. Mika Nieminen (TAMK) and Prof. Dr.-Ing. Wilfried Stiller (FHH) for the support, the provided material and the fruitful conversations; Volkswagen Nutzfahrzeuge Hannover, Germany for the financial support during the past four years of my studies and especially Ms. Erika Sündermann for her engagement to make my stay in Finland possible; Miska Koivulehto (UTA) for his engagement to nominate me as NGO-observer for the participation on UNFCCC COP15; Kai Becker (LSE London) for fruitful conversations and supporting my expert consultation; Sören Miehe (University of Mainz) and Brad Lanute (University of Temple and UTA) for the interesting conversations and the provided material; Tim Ellermann for hosting in Copenhagen and – last but not least- Martin Kaltenbacher (University of Vienna and UTA) for the authentic pictures and the intensive travel to Copenhagen in December 2009.

The printed version of my Bachelor's Thesis (at TAMK) contains an attached CD with photos taken during COP 15 in Copenhagen in December 2009. The photos are provided by Martin Kaltenbacher and represent his intellectual property.

TABLE OF CONTENT

Acronyms, Abbreviations and General Expressions

AAU	Assigned Amount Unit (exchanged through emissions trading)
AGBM	Ad hoc Group on the Berlin Mandate
AIE	Accredited Independent Entity (under Joint Implementation Track II)
AWG / AWG-KP	Ad hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
AIP	Annex I Parties
AR4	Fourth Assessment Report (by the IPCC)
AOSIS	Alliance of Small Island States
AWG-KP	Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
BAP	Bali Action Plan
BAPA	Buenos Aires Plan of Action
BAT	Best available technology
BINGO	Business and industry NGO
CAP	Commitment Achievement Plan
CCS	Carbon capture and storage
CDM	Clean Development Mechanism (under the Kyoto Protocol)
CDM EB	Clean Development Mechanism Executive Board
CER	Certified emission reduction (generated through the CDM)
CH_4	Methane
CGE	Consultative Group of Experts on National Communications from Parties not Included in Annex I to the Convention
CIF	Climate Investment Fund
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol

COP	Conference of Parties (to the UNFCCC)
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2-eq	Carbon dioxide equivalent
CPR	Commitment period reserve
CRU	Climate Research Unit (of the University of East Anglia, UK)
CSS	Carbon Capture and Storage
DOE	Designated operational entity (under the CDM)
DNA	Designated national authority (under the CDM)
EGTT	Expert Group on Technology Transfer
EIT	Country with economy in transition
EIG	Environmental Integrity Group
ERU	Emission reduction unit
EU	European Union
EU ETS	European Union Emission Trading Scheme
FAO	Food and Agriculture Organization
FoE	Friends of the Earth
GCCA	Global Campaign for Climate Action
GDP	Gross National Product
GDP_{PPP}	Gross Domestic Product based on Purchasing Power Parity
GEF	Global Environment Facility
GHG	Greenhouse gas
GRULAC	Central and Eastern Europe, Latin America and the Caribbean States
$GtCO_2$	Giga tons carbon dioxide
GWP	Global warming potential
HFC	Hexafluorocarbon
ICC	Inuit Circumpolar Council
IEA	International Energy Agency
IET	International Emission Trading

IGO	Intergovernmental organization
IMO	International Maritime Organization
INC	Intergovernmental Negotiating Committee for a Framework Convention on Climate Change
IPCC	Intergovernmental Panel On Climate Change
IPO	Indigenous Peoples' Organizations
JI	Joint Implementation (under the Kyoto Protocol)
JISC	Joint Implementation Supervisory Committee (under the Kyoto Protocol)
JWG	Joint Working Group
lCER	Long-term CER
LCDS	Low-carbon development strategies
LDC	Least developed country
LEG	Least Developed Countries Expert Group
LGMA	Local Government and Municipal Authorities
LLGHG	Long-lived greenhouse gas
LULUCF	Land use, land use change and forestry
MOC	Meridional overturning circulation
MOP	See CMP
N_2O	Nitrous oxide
NAIP	Non-Annex I Parties
NAP	National Allocation Plan (under the EU ETS)
NGO	Non-governmental organisation
NO_x	Nitrogen oxide
O_3	Ozone
OECD	Organization for Economic Co-operation and Development
OPEC	Organization of Petroleum Exporting Countries
PFC	Perfluorocarbon
ppb	Parts per billion
ppm	Parts per million

QELRO	Quantified emission limitation and reduction objectives
REDD	Reducing emissions from deforestation and forest degradation
RINGO	Research-Oriented and Independent Organizations
RMU	Removal Unit (generated by LULUCF projects)
SBs	Subsidiary Bodies
SBI	Subsidiary Body for Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SIDS	Small Island Developing States
SRES	Special Report of Emission Scenarios (of the IPCC (2000))
tCER	Temporary CER
TPES	Total Primary Energy Supply
TFB	Task Force Bureau on National Greenhouse Gas Inventories (under the IPCC)
TFI	Task Force on National Greenhouse Gas Inventories (under the IPCC)
TGICA	Task Force on Data and Scenario Support for Impacts and Climate Analysis (under the IPCC)
UNCED	United Nations Conference on Environment and Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
UNU	United Nations University
WEOG	Western Europe and Others
WHO	World Health Organization
WMO	World Meteorological Organization
WWF	Worldwide Wildlife Foundation

The 15th Session of the Conference of the Parties (COP 15) to the United Nations Framework Convention on Climate Change (UNFCCC), to be held in Copenhagen in December 2009, (…) will be the most important international gathering since the Second World War.

Nicholas Stern, 2009

(Chair of the Grantham Research Institute on Climate Change and the Environment, and I.G. Patel Professor of Economics & Government, London School of Economics (LSE))

1. Introduction

Climate Change represents one of the greatest challenges of the 21st century. Since the beginning of industrialization during the second half in the 18th century, mankind has continuously developed new technologies and infrastructures which have significantly changed and increased the standards of living of people, first in Europe and Northern America and subsequently in Asia and Latin America. The development of techniques and machines which convert potential energy into work has heavily increased the economies' outputs – but, vice versa, as well the demand for energy. The combustion of slowly renewable and fossil fuels since the beginning of the industrialization period to cover the continuously growing global energy needs has led, beside all positive effects on living standards, to an increase of carbon dioxide in the atmosphere from 280ppm in pre-industrial times to 379ppm in 2005 (IPCC 2007: 37). Carbon dioxide, which is the most important anthropogenic greenhouse gas (GHG), represents the major reason for increasing atmospheric GHG concentrations, and (therewith linked) the increase of global mean temperatures up to 0.76°C in 2001-2005 above pre-industrial times (IPCC 2007b: 36). Observed global warming has already a strong influence on ecosystems, peoples' livelihoods and development of nations, and these effects are expected to intensify, if anthropogenic emissions and therefore global warming continues. The historical responsibility of countries that have developed early and emitted the major share of GHGs – the so-called developed countries – is in contrast to the development of countries whose development performance is strongly connected with increasing anthropogenic emissions. Least developed countries and island states - that have marginal cumulative emissions - represent the most vulnerable countries for climate change impacts Therefore climate change is a global phenomenon, which is strongly connected with economic policy, energy policy, development policy and environmental policy in long-term ranges and has to be addressed globally in a comprehensive way. The United Nations Framework Convention on Climate Change (UNFCCC) represents global political frame to address climate change. The Kyoto Protocol, which was adopted in 1997 under the auspices of the UNFCCC, was the first binding agreement of quantified emission reductions of developed countries. The first commitment period of the Kyoto Protocol will end in 2012, therefore countries under the UNFCCC agreed in 2007 in Bali to work on a long-term cooperative action in a post-2012 agreement, which should be finalized at the Conference of Parties (COP) 15 in Copenhagen in December 2009. Therefore this conference is expected to set the course for climate change stabilization, global development and sustainability strategies.

The aim of this Bachelor's Thesis is to analyze if and to which extend COP 15 has been successful in addressing climate change based on the three drafted approaches. Furthermore it describes the kind of climate change impacts which humans will most likely have to adapt to. First, the theoretical background about the UNFCCC, the IPCC and important UNFCCC decisions such as the Kyoto Protocol (1997) and the Bali Road Map (2007) is given. Subsequently, the results and outcomes of COP 15 are assessed based on a literature analysis, which focuses on three different approaches to a post-2012 agreement. In the concluding section, an outlook for future climate negotiations is given.

Theoretical Part

The theoretical part of this thesis represents the basis for the evaluation of the UNFCCC COP 15 and is divided into four chapters. Chapter 2 describes the development of the United Nations Framework Convention on Climate Change, important elements of the Convention text and institutions under the Convention. Furthermore the negotiating parties as well as observer groups are presented. The third chapter deals with the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). First, the history and the organizational structure of the IPCC is explained and subsequently key findings which are important for the empirical part of this thesis are outlined. Hence the Kyoto Protocol and the financial mechanism under the Protocol are described in Chapter 4, which concludes with presenting the European Union Emission Trading Scheme (EU ETS). The fifth chapter deals with the Bali Road Map and its building blocks for a post-2012 framework.

2. United Nations Framework Convention on Climate Change

2.1 History

Based on the United Nations (UN) General Assembly of December 21st, 1990, Resolution 45/212 was adopted to constitute the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (INC) (UNFCCC 2006: 18).

Preparations to establish “an effective framework convention on climate change, containing appropriate commitments, and any related instruments as might be agreed upon” (UN 1991: 3) represented the major goal of the INC since its first session, held in February 1991 in Washington D.C., USA. The INC finished its work and presented a Convention text which was then adopted by the UN Headquarters on May 9th, 1992 after a working period of 15 months and five sessions. The Convention text was finalized to be signed as a legally binding treaty for UN member states during the United Nations Conference on Environment and Development (UNCED), which took place in Rio de Janeiro, Brazil in June 1992. Actions by the INC, the United Nations Framework Convention on Climate Change (UNFCCC), came into effect on 21 March 1994 after the ratification period and implementation.

The UNFCCC, signed by 166 UN member states on the UNCED, is currently signed by 193 states and one regional economic integration organization (the European Community) (UNFCCC 2010). In March and April 1995 Berlin, Germany hosted the first Conference of Parties (COP) under the body of the UNFCCC (UNFCCC 2006: 19). Subsequent to the COP 1, annual meetings of the COP have taken place since 1995.

The “Berlin Mandate”, which was adopted during the COP 1 in Berlin, contained the first steps towards enacting a legally binding treaty for commitments on greenhouse gas (GHG) emission reductions, including the deadline for finalizing a multilateral treaty with the conclusion of the COP 3 meetings to take place in 1997 on COP 3 (UNFCCC 2006: 19). During COP 3, which took place in December 1997 in Kyoto, Japan, the “Kyoto Protocol” was approved after intensive discussions, and contained legally

binding emission reductions for industrialized countries. The following COP meetings negotiated the modalities under the Kyoto Protocol and further the implementation of sustainable technologies and instruments to achieve sustainable development. The developments stemming from both COP 6.5 (Bonn, Germany in 2000) and COP 7 (Marrakech, Morocco in 2001) established the legislative basis for enabling the Kyoto Protocol to become operative on February 16th, 2005 (UNFCCC 2006: 19-20).
The "Bali Road Map" mandated a follow-up agreement of the Kyoto Protocol based on COP 13 negotiations in Bali, Indonesia in 2007. The Parties under the UNFCCC committed themselves to adopt legally binding agreements by 2009 on COP 15 to replace the Kyoto Protocol, which is due to expire in 2012, and to implement emission reduction targets for a post-Kyoto period (UNFCCC 2007a).

2.2 The Convention Text of the UNFCCC

As described above, the Convention text represents a legal treaty between 193 states and one regional economic integration organization. The Convention text contains 26 articles which define the legal foundation of the UNFCCC, objectives, principles, commitments, Convention bodies and its functions, financial rules, guidelines and procedures for decision-making and the implementation of decisions.

2.2.1 Objective

The major objective of the UNFCCC is described in Article 2 of the Convention text. The second article of the Convention text describes its ultimate objective which is *"to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"* (UNFCCC 1992: 4). The Convention text expresses that climate change and the impacts of global warming caused by anthropogenic greenhouse gas (GHG) emissions are considered to be severe threats for ecosystems and for regional environments.
This qualified objective is neither linked with quantitative emission reduction targets nor with certain threshold values as the limit of the atmospheric GHG concentrations e.g. (UNFCCC 2006: 21). Additionally the term GHG is not clearly described. Related to a quantifiable time-frame Article 2 defines that decisions concerning GHG concentrations and emission reductions should be taken in accordance with sustainable ecological and economic development. *"Such a* [GHG concentration] *level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."* (UNFCCC 1992: 4)

2.2.2 Principles

The Convention is based on principles which are defined in Article 3 of the Convention text to achieve the objectives which are laid out in Article 2. The principles contain the approach to consider climate change as a collective challenge but different economic and geographical constitutions and capacities of the Parties should be taken into account. Therefore *"[t]he Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance*

with their common but differentiated responsibilities and respective capabilities. […] *[T]he developed country Parties should take the lead in combating climate change and the adverse effects thereof*" (UNFCCC 1992: 4)

Further, a differentiation between socio-economic factors and the degree of vulnerability to climate change impacts is reflected in the following paragraph: *"The specific needs and special circumstances of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change, and of those Parties, especially developing country Parties, that would have to bear a disproportionate or abnormal burden under the Convention, should be given full consideration"* (UNFCCC 1992: 4) A collective advancement represents the basis for preventing climate change besides distinguishing between different socio-economic capacities. Hence "*precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects"* (UNFCCC 1992: 4) should be based on *"sustainable development* [which is] *appropriate for the specific conditions of each Party and should be integrated with national development programmes"* (UNFCCC 1992: 5). Therefore Article 3 claims a shift towards sustainable economic activities to guarantee development as an enabling prerequisite for preventing climate change: "*The Parties should cooperate to promote a supportive and open international economic system that would lead to sustainable economic growth and development in all Parties, particularly developing country Parties, thus enabling them better to address the problems of climate change"* (UNFCCC 1992: 5). As Article 2, the third article of the Convention text does not establish concrete milestones for a sustainable economic system or describe quantifiable targets. Therefore objectives and principles of the UNFCCC represent qualified targets and a frame in which decisions can be made, but contrariwise a long-range clearance is given, which might lead to complex, time-consuming and insufficient decisions.

2.2.3 Commitments

All Parties to the Convention have committed themselves to adhering to the following fundamentals, since the Convention text represents a multinational binding treaty. Additionally, these commitments, which are based on Article 4 of the Convention text, have to be incorporated into national development strategies (UNFCCC 2007: 16; UNFCCC 1992: 5-10):

- Quantified measurements of national GHG emissions and national climate change mitigation performance
- Implementation of appropriate actions to develop sustainable technologies and provisions to manage ecosystems, which allegorize a potential carbon sink
- Adequate actions to be sufficiently prepared for climate change adaptation
- Strategies to increase the scientific expertise of climate change and research plans to observe climate change; obligation for scientific co-operation and data-exchange
- Implementation of educational actions to engage the public consciousness due to climate change

These key commitments establish the Convention's base for long-term strategies regarding climate change mitigation and adaptation as well as the means to deal multilaterally with impacts of anthropogenic GHG emissions in a cooperative and conscious manner, independent of concrete emission reduction targets.

2.2.4 Institutional Bodies

The UNFCCC can be divided into several bodies on the institutional level. Every established institutional body of the Convention is committed to act in the frame of its responsibilities and its respective fields (UNFCCC 2006: 27).

Conference of Parties (COP)

The Conference of Parties (COP) is defined as "*the supreme body of this Convention*" (UNFCCC 1992: 10) and constitutes the highest authority of the Convention for decision-making and is to supervise its legal requirements and responsibilities adapted from Article 7 of the Convention text. The responsibilities of the COP are defined as (UNFCCC 1992: 10-12):

- Examination of the Parties' obligations referring to the Convention's objective (commitments, implementation of climate change policies based on scientific knowledge)
- Information exchange and its coordination according to the commitments of the Convention
- Enhance the refinement of comparable methods to measure and to limit GHG emission concentrations
- Assessment of Parties' realization of commitments; further consider reports of the implementation of the Convention and give advices for implementation strategies
- Application for the mobilization of financial resources
- Review reports of the Subsidized Bodies (SBs)

The COP is held in plenary sessions based on a provisional agenda, which is provided by the secretariat (in agreement with the President). Parties are allowed, according to the Draft Rules of Procedure, to submit additional proposals for an agenda. Heads of the respective ministries of the Parties usually participate during the final days of the COP. Heads of States were invited to negotiate at COP 15 based on an initiative of the Executive Secretary of the UNFCCC (UNFCCC 2009). Plenary meetings are held in public (video and audio documents are available via the UNFCCC homepage[1]) (UNFCCC 2006: 29).

COP President and Bureau

The COP President and Bureau usually, according to the Draft Rules of Procedure belong to the ministry for environment of the COP hosting country. The COP President is represented by the respective head of the ministry and immediately elected by the COP after the opening ceremony.

[1] www.unfccc.int

The institutional function of the COP is to organize and enable climate change negotiations under the body of the COP. Furthermore, it gives impartial and methodological support to abet negotiations independently towards an agreement establishing the main principle of the COP President (UNFCCC 2006: 31). Therefore the COP President represents an independent panel chairman.
The COP Bureau remains active between COP sessions. Composed of 11 officers (the COP President, seven Vice-Presidents and the Chairs of the two SBs and one Rapporteur) the COP Bureau is elected for a period of one year. One consists of a representative of the Small Island Developing States (SIDS) beside representatives of the five United Nations regional groups. Since neither the Draft Rules of Procedure nor the Convention contains an explicit description of the responsibilities, the COP Bureau supports and organizes concerns between the COP, the COP President and additionally helps the UNFCCC Secretariat to facilitate COP sessions (Allocation of Acquisitions for COPs e.g.) (UNFCCC 2006: 31).

Subsidiary Bodies (SBs)

Under the Convention two permanent subsidiary bodies (SBs) are founded to council the COP. Generally both bodies are open for members of all parties and representatives with expertise of member states.
The Subsidiary Body for Scientific and Technological Advice (SBSTA) is based on Article 9 of the Convention and its respective duty is established to provide "*timely information and advice on scientific and technological matters relating to the Convention*" (UNFCCC 1992: 13). Therefore the SBSTA develops, enhances and advances methodologies to compare national appraisals of GHG emissions and abatements of GHGs. Furthermore, assessments about the effects of proposed and past decisions, which are considered to be implemented in the Convention and methodological approaches in specific working fields as land use, land use change and forestry (LULUCF) e.g. represent key assignments of this SB (UNFCCC 2006: 33-35).
The Subsidiary Body for Implementation (SBI) is established to assist and advise the COP by reviewing decisions taken by the Convention and by supporting the COP for the effective implementation of decisions, based on Article 10 of the Convention (UNFCCC 1992: 14). Drafts for COP decisions provided by Parties are considered and assessed by the SBI. Financial mechanisms under the Convention (Emission Trading / Clean Development Mechanism (CDM) and Joint Implementation (JI) e.g.) are assessed continuously to reconsider the proportionality of commitments and to support developing countries in implementing their commitments under the Convention (UNFCCC 2006: 35-36).

The Secretariat

The Secretariat under the Convention – the Climate Change Secretariat – is responsible for formal and organizational occurrences based on Article 8 of the Convention (UNFCCC 1992: 12). The secretariat provides official documents, arranges meetings/sessions, coordinates work flows with other international bodies (IPCC/ UNEP /UNDP e.g.), serves as an institutional body the COP, the SBs, the

Bureau and other bodies (UNFCCC 2007: 16) and is located in Bonn, Germany since 1996. The secretariat is also institutionally connected with the United Nations. Since August 1996, Mr. Yvo de Boer has represented the Executive Secretary but he will retire effective July 10th, 2010 (UNFCCC 2006: 36-37; UNFCCC 2010a).

Other Bodies

As an outcome of several COP policies, other bodies have been established to accomplish specific assigned tasks and to report their results to the COP (UNFCCC 2006: 37). The Ad hoc Working Group on the Berlin Mandate (AGBM) was founded on COP 1 in 1995 (Decision 1/CP.1) to arrange negotiations for developing an emission reduction mechanism for Parties under the Convention by 1997. The Kyoto Protocol was adopted on COP 3 in 1997 based on the results of the AGBM (UNFCCC 1995: 4-6). The Joint Working Group (JWG) was formed in 1995 (Decisions 4/CP.1 and 6/CP.1) to coordinate the information exchange between the SBSTA and the Intergovernmental Panel on Climate Change (IPCC) (UNFCCC 1995: 15-16; 21-23).

The open-ended Ad hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG, later renamed in AWG-KP) was established on COP 11 in 2005 to continuously coordinate general work on evaluating further emission reductions under the Kyoto Protocol beyond 2012 (Decision 1/CMP.1) based on climate change negotiation for a post-Kyoto Protocol period (UNFCCC 2006: 38). COP 13 in 2007 launched the Ad hoc working Group on Long-Term Cooperative Action under the Convention (AWG-LCA) to ensure to reach the obligated targets of the Bali Road Map. Based on negotiations of the AWG-LCA concrete measures and commitments should be provided to be adopted at COP 15 in 2009 (UNFCCC 2007b: 4).

Additional limited-membership groups represent bodies to gain and provide expertise for certain fields (UNFCCC 2006: 38-39):

- The Expert Group on Technology Transfer (EGTT)
- The Consultative Group of Experts on National Communications from Parties not Included in Annex I to the Convention (CGE)
- Least Developed Countries Expert Group (LEG)

Draft Rules of Procedure / Decision-Making

Draft rules of procedure were adopted on COP 1 to regulate the sequence of events on COPs. These rules describe the processes for decision making, voting, defining date and place of sessions, agenda adoption, financial budgeting and the conduction of business, which are not contained in the Convention text. The draft rules of procedure also contain the areas of responsibilities of certain institutions and officers (COP President, the Secretariat e.g.) (UNFCCC 2006: 41).

Decision-making processes are generally based on the Convention text (Article 15) and on the rules of procedure (Rule 42). Therefore decisions should contain "*every effort to reach agreement on any proposed amendment to the Convention by consensus"* (UNFCCC 1992: 18). Consensus in this certain

case means that every Party with a right to vote has to agree to the proposal – otherwise an agreement is not legally binding.

2.3 Parties and Groups under the Convention

Generally, different groups of Parties and negotiating groups can be defined under the Convention. Besides observer states[2] and regional groups, which are in accordance with the United Nations practice[3], the Convention consists of 193 states and one regional economic integration organization, which have signed and ratified the Convention (UNFCCC 2010; UNFCCC 2006: 44-45). Member states are divided into different groups with different obligations and commitments.2.3.1 Groups of Parties under the Convention, according to the "common but differentiated responsibilities and respective capacities" (Article 3 of the Convention, see chapter 2.2.2).

2.3.1 Groups of Parties under the Convention

Under the Convention three major groups of states are established, namely Annex I Parties (AIP), Annex II Parties and non-Annex I Parties. This differentiation refers to the appendix of the Convention text and to Article 3 of the Convention (UNFCCC 1992: 23; UNFCCC 2006: 46).

- Annex I Parties (AIP)

The Group of AIP consists of 41 industrialized countries which are members of the Organization for Economic Co-operation and Development (OECD) and represent relatively prosperity. Additionally, countries with economies in transition (EITs) belong to the AIP as well. Therefore this group contains countries with huge financial, institutional and infrastructural capacities for commitments to mitigate climate change (UNFCCC 2006: 46). A list of Annex I Party countries is provided in the Appendix I.

- Annex II Parties

Currently 24 Annex I countries represent the Annex II Parties who are all members of the OECD. Developed country Parties have the obligation to "*provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of implementing measures* [to address climate change]*"* (UNFCCC 1992: 8), according to Article 4.3 of the Convention. The transfer of technologies (to developing countries and EITs), which don't interact with the atmospheric climate system, represents an additional obligation for the Annex II Parties (UNFCCC 2006: 47). A list of Annex I Party countries is provided in the Appendix II.

[2] Observer states are countries, which are not member states of the Convention but have been invited by the COP President to participate without the right to vote at COP or SBs sessions.

[3] Regional Groups are: Africa, Asia, Central and Eastern Europe, Latin America and the Caribbean States (GRULAC), Western Europe and Others (WEOG)

- Non-Annex I Parties (NAIP)

Countries which are not listed in Annex I and Annex II of the Convention allegorize the so-called non-Annex I countries (NAIP). Smaller financial, institutional and infrastructural capacities (compared to Annex I countries) characterize generally the constitution of NAIPs. Concerning the constitution of non-Annex I Parties it has to be distinguished between the currently rapid emerging economies China and India and the Least Developed Countries (LDCs) e.g., who all belong to this group.

- Countries with Economies in Transition (EITs)

Former Soviet Union countries and satellite states of the Soviet Union belong to the group of Countries with Economies in Transition (EITs). A *"certain degree of flexibility shall be allowed by the Conference of the Parties to the Parties included in Annex I undergoing the process of transition to a market economy"* (UNFCCC 1992: 8) related to Article 4.6 of the Convention. The Convention offers a more flexible scope to EITs compared to other AIP to accommodate the economic change of EITs with climate change obligations (as a member of the Annex I Parties) (UNFCCC 2006: 48). A list of EITs is provided in the Appendix III.

- Least Developed Countries (LDCs)

Referring to the classification of Least Developed Countries (LDCs) by the UN[4], except Somalia, all LDCs belong to the LDCs Group under the Convention. The LDCs are protected by Article 4.9 of the Convention which emphasizes "the *specific needs and special situations of the least developed countries*" (UNFCCC 2006: 9), due to very small financial and institutional capacities and a high vulnerability to climate change impacts. Therefore decisions of the COP should include a provision of funding and technologies for the LDCs (UNFCCC 2006: 48).

2.3.2 Political Negotiating Groups

Most Parties are members of one or more political negotiating groups to connect common interests of Parties under the Convention and to strengthen common positions in negotiation processes. These groups discuss and negotiate (mainly in closed meetings) about negotiating positions and strategies to address common and/or shared vulnerabilities.

Often postulations or proposals for an agreement result of these group-intern negotiations. A common position is represented by the chair of the group in the COP, whose number of votes equals the number of members, who are entitled to vote. If no shared position can be found, the Parties represent themselves in the COP.

The reasons which have led to form these groups differ from regional economic integration, common concerns or similar vulnerabilities to climate change impacts. Namely, the following political negotiating groups can be stated (UNFCCC 2006: 49-51):

- Group of G77 and China (132 members)
- African Group (53 members)

[4] http://www.unohrlls.org/en/ldc/related/62/

- Alliance of Small Islands States (AOSIS) (43 members)
- Central Group (3 members)
- European Union (EU) (27 members)
- Umbrella Group (9 members)
- Environmental Integrity Group (EIG) (3 members)
- Organization of Petroleum Exporting Countries (OPEC) (10 members)

2.4 Observer Organizations

Observers are allowed to participate at COPs based on the draft rules of procedure. *"[S]uch observers may, upon invitation of the President, participate without the right to vote in the proceedings of any session in matters of direct concern to the body or agency they represent"* (UNFCCC 2006a) to represent the civil society. Generally, it has to be distinguished between UN- and UN-related bodies and intergovernmental and non-governmental organizations (IGOs and NGOs), who are allowed to participate as observers. The United Nations Conference on Trade and Development (UNCTAD), United Nations Environment Programmed (UNEP), the United Nations Institute for Training and Research (UNITAR) and the United Nations University (UNU) usually attend on sessions of Convention bodies due to strong work co-operation or consultations on institutional level. Furthermore UN-related bodies and agencies such as the IPCC, the Food and Agriculture Organization (FAO), the Global Environment Facility (GEF), the United Nations Industrial Development Organization (UNIDO), the World Bank, the World Health Organization (WHO), the World Meteorological Organization (WMO), the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO) are counted as observer organizations as well (UNFCCC 2006: 62).

Both intergovernmental organizations (IGOs) such as the OECD, the OPEC or the International Energy Agency (IEA), as well as non-governmental organizations (NGOs) participate in sessions of Convention bodies in order to observe the negotiations and to communicate their positions and proposals to representatives of Parties. Five different types of NGOs can be stated (UNFCCC 2006: 63):

- Business and Industry NGOs (BINGOs)
- Environmental NGOs (ENGOs)
- Indigenous Peoples' Organizations (IPO)
- Local Government and Municipal Authorities (LGMAs)
- Research-Oriented and Independent Organizations (RINGOs)

Observer organizations regularly organize side-events and exhibits at COP sessions where research results, climate negotiations, proposals for climate policies, technologies, economic instruments / mechanisms and positions of certain interest groups are presented and intensively discussed. On COP 15 more than 240 side events and 190 exhibits took place during the two weeks of the summit (UNFCCC 2010b).

3. The Intergovernmental Panel on Climate Change (IPCC)

3.1 History, Duties and Responsibilities

The Intergovernmental Panel on Climate Change (IPCC)[5] was jointly established in 1988 by the WMO and the UNEP and confirmed by the United Nations General Assembly on December, 6th 1988 "*to provide internationally co-ordinated scientific assessments of the magnitude, timing and potential environmental and socio-economic impact of climate change"* (UN 1988). The continuously increasing understanding of interdependencies between anthropogenic activities and climate change has led to found a body, which assesses scientific, technical and socio-economic information. Furthermore, options and strategies to adapt and to mitigate climate change are reconsidered based on available information. Objective assessments of impacts, options to adapt and mitigate climate change should be "neutral with respect to policy" (IPCC 2006: 1) according to the principles of the IPCC. The IPCC defines its role as "*understanding the scientific basis of risk of human-induced climate change […] on a comprehensive, objective, open and transparent basis* (IPCC 2006: 1).

The IPCC collocates and synthesizes mainly peer-reviewed information, which is provided and published by research institutes to provide up-to date policy-relevant information (IPCC 2006: 1; IPCC 2010). Therefore the Panel cannot be considered as an actively researching body. The IPCC has published and updated its assessments in four IPCC Assessment Reports in 1990, 1995, 2001 and 2007, which have played an important and influential role to provide scientific knowledge for decision-making, especially pertaining to UNFCCC decisions and agreements (IPCC 2010a). Special reports on specific issues or tasks as "Carbon Dioxide Capture and Storage" (IPCC 2005) or "Emission Scenarios" (SRES) (IPCC 2000) e.g. are regularly published.

The IPCC is honored with the Nobel Peace Prize in 2007 "*for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change*" (Nobel Price Foundation 2007).

3.2 Organization

The IPCC, based in Geneva, Switzerland is open for all member countries of the WHO and the UNEP. Generally the IPCC is organized by the IPCC Bureau, the IPCC Working Group Bureaus and the Task Force Bureaus (IPCC 2006: 1). The Indian economist Dr. Rajendra K. Pachauri represents the Chair of the IPCC Bureau since 2002 (IPCC 2010b). The IPCC Bureau consists of three Vice-Chairs, the Co-Chairs of the three Working Groups and the Task Force Bureau on National Greenhouse Gas Inventories (TFB) and the Vice-Chairs of the Working Groups (IPCC 2010b).

Three Working Groups are established under the IPCC to distinguish between different aspects of climate change:

[5] www.ipcc.ch

- Working Group I

The Working Group I describes and assesses physical-scientific facets of climate change. This contains observed changes of atmospheric GHG concentrations, observed changes of air, land and sea water temperatures, rainfall intensities, sea level fluctuations and changes in ice sheets and glacier structures. Reconstructions of historical climate processes and models to predict future climate changes represent furthermore aspects of the working field of Working Group I (IPCC 2010c).

- Working Group II

The Working Group II mainly focuses on the assessment of socio-economic impacts of climate change. Vulnerability and climate change adaptation potentials, negative and positive outcomes of climate change and the focus on sustainable development are analyzed in relation to specific sectors (food, industry, water e.g.) and geographical regions (IPCC 2010c).

- Working Group III

The Working Group III analyses and assesses climate change mitigation options in relation short- and long term emission reduction scenarios. Costs and benefits for the main economic sectors (energy, transportation, agriculture e.g.) are reconsidered under the purpose to assess socio-economic mechanisms and to prepare possible solutions for policy-makers (IPCC 2010c).

Temporary task forces concentrate on the assessment of specific topics (see 3.1) while two open-ended task-forces are established under the IPCC:

- The Task Force on National Greenhouse Gas Inventories (TFI)
- The Task Force on Data and Scenario Support for Impacts and Climate Analysis (TGICA)

Article 21 of the UNFCCC describes the cooperation between the IPCC and bodies of the Convention, in particular the secretariat "*to ensure that the Panel can respond to the need for objective scientific and technical advice*" (UNFCCC 1992: 20). The Joint Working Group (JWG) which was established in 1995 connects information exchange between the SBSTA and the IPCC and is composed of chairs both from Convention bodies and the IPCC (UNFCCC 2006: 55). The Second, the Third, and the Fourth Assessment Report (AR4) of the IPCC were recognized by the COP as the "*most comprehensive and authoritative assessment of climate change to date, providing an integrated scientific, technical and socio-economic perspective on relevant issues*" (UNFCCC 2007c: 29) according to COP Decisions 6/CP.2, 25/CP.7 and 5/CP.13. Therefore the IPCC Assessment Reports determine the scientific foundation for multilateral decision-making under the UNFCCC.

The IPCC encourages scientists worldwide to contribute their scientific approaches and results to climate change related issues, due to the fact that the IPCC doesn't research actively. Therefore, thousands of scientists voluntarily submit their research results to the IPCC, which reviews the contributed information (UNFCCC 2006: 54).

The reviewing process represents "*an essential part of the IPCC process [and] should involve both peer review by experts and review by governments"* (IPCC 2006:1). Six methodological units can be

allegorized, based on specific procedures, which describe the order of mandatory consecutive processes from preparation to the final publication of an IPCC Assessment Report: listing of lead authors, expert reviewers and review editors; selection of lead authors; preparation of a draft report; two reviews (1. expert and 2. expert and governmental review); preparation of final report; acceptance of final report (IPCC 2008: 4).

Especially in advance and after the COP 15 in December 2009 and since the webmail server hack of the Climate Research Unit (CRU) of the University of East Anglia, UK in November 2009 (Guardian 2009), climate change skeptics and supporter of the so-called "climate-gate"[6] criticized methods of climate researchers, doubted conclusions of climatology and subsequent contested the whole climate science (Guardian 2010b).

Some objective errors in the AR4 of the IPCC have to be stated without responding to this discussion (but with a strong belief in climate science). These errors, reconsidered in the online-blog "RealClimate.org"[7] (RealCliamte.org 2010), have led to start an intensive public discussion about improving reviewing procedures of the IPCC and of handling climate science data more transparently (Spiegel Online 2010; Guardian 2010b; RealClimate.org 2010).

3.3 Fourth Assessment Report of the IPCC (AR4)

The Fourth Assessment Report of the IPCC (AR4) was published in 2007. Named "Climate Change 2007", it consists of three reports which are contributions of the IPCC Working Groups. A recapitulatory report, "Climate Change 2007: Synthesis Report" (IPCC 2007) contains the key points of all IPCC Working Group reports and was prepared as a "*readable and concise document explicitly targeted to the policymakers*" (IPCC 2007g). More than 450 lead authors, 800 contributing authors and 2500 reviewing experts have written the AR4, based on more than 90.000 submitted contributions (RealClimate.org 2010).

The influence of governments in the AR4 was criticized especially by scientists concerning proposed weakening of terms and expressions. Governments of countries such as USA, China and Saudi Arabia described scientific approaches to climate change impacts as "too extensive"[8] (Spiegel Online 2007) and therefore tried to influence dictions in chapters, which describe hurricanes, droughts, floods and wild fires (Spiegel Online 2007; Spiegel Online 2007a).

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[6] http://www.climate-gate.org/

[7] RealClimate.org is an online-blog published by international renowned climate scientists such as S. Rahmstdorf (Potsdam Institute for Climate Impact Research, Germany), G. Schmidt (NASA Goddard Institute for Space Studies, New York, USA), Raymond Pierrehumbert (Louis Block Professor in Geophysical Sciences at the University of Chicago, USA) et al. Discussion about to climate-related scientific articles and publications allegorize the core of this blog.

[8] Own translation: ("Die Regierungen dieser Länder hätten einige Abschnitte des Berichtes insbesondere zu den Wirkungen des Klimawandels als zu weitgehend beanstandet") Spiegel Online 2007

The following paragraphs mainly emphasize aspects of the AR4 which are important for answering the research question related to the delimited topic of this thesis (and the limited space). Therefore the AR4 is not going to be summarized entirely.

3.3.1 The Physical Science Basis (Working Group I)

Human and Natural Influences on the Earth's Climate System

The interaction of solar radiation with the Earth's climate system can be described as reflection, absorption and emission of energy at the Earth's surface and within the atmosphere. Properties of the atmosphere to respond to incoming solar energy are determined by the concentration of GHGs and their radiative forcing potential; hence GHG concentrations changes influence the properties of the atmosphere (IPCC 2007b: 21).

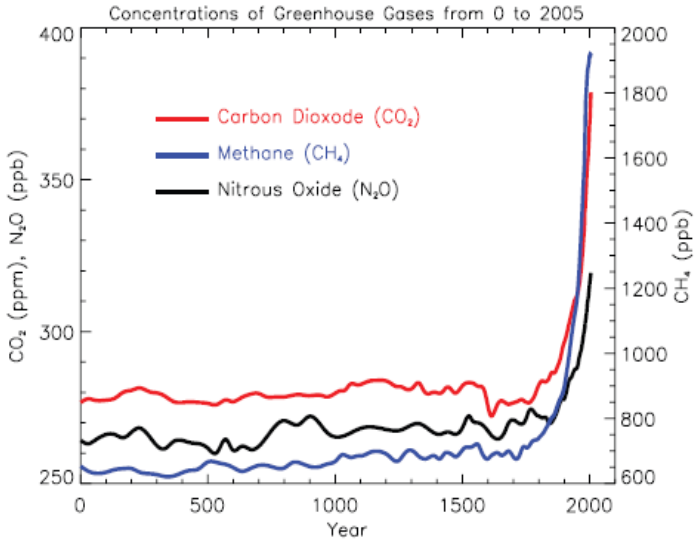

Figure I: Changes of atmospheric CO_2, CH_4 and N_2O concentrations over the past 2.000 years (IPCC 2007b: 100)

The atmospheric concentration of carbon dioxide (CO_2), the most important anthropogenic GHG, has increased from 280 parts per million (ppm) in pre-industrialized times to 379ppm in 2005 and represents a record concentration over the past 650.000 years (IPCC 2007a: 2). Measurements of the annual growth rate of CO_2 concentrations have proved an increase from 1.4ppm per year in 1960-2005 to 1.9ppm per year in 1995-2005. Fossil fuel use represents the major source for CO_2 (IPCC 2007a: 3). The annual positive carbon flux from 3.3±0.1GtCO_2 in the 1980s has increased to 4.1GtCO_2 in the period 2000-2005 related to the global carbon budget (IPCC 2007a: 26).

The increases of atmospheric concentrations – compared to pre-industrial levels- of methane (CH_4) from 715 parts per billion (ppb) to 1774ppb in 2005 and nitrous oxide (N_2O) from 270ppb to 319ppb in 2005 (IPCC 2007b: 27) are due to anthropogenic emissions – mainly agriculture (IPCC 2007a: 3) (see Figure 1).

Therefore, the radiative forcings of these long-lived greenhouse gases (LLGHGs) have (relatively to

pre-industrial times) increased by +1.66±0.17 Wm^{-2} (CO_2), +0.48±0.05 Wm^{-2} (CH_4) and +0.16±0.02 Wm^{-2} (N_2O) until 2005 (IPCC 2007b: 25,27) corresponding to the increased atmospheric concentrations of CO_2, CH_4 and N_2O. The total net anthropogenic radiative forcing is +1.6 (0.6-2.4) Wm^{-2}, taking besides the LLGHGs all warming and cooling radiative forcings into account (IPCC 2007b: 32). Changes in radiative forcings of the anthropogenic GHGs have a much higher influence on climate change than changes in radiative forcings of natural GHGs (IPCC 2007b: 102).

Observations of Climate Change

The following paragraph describes qualitative and quantitative observations of climate change. The IPCC stated that it is very unlikely[9] that climate change can be explained only with natural forces, hence it is very likely that anthropogenic drivers have influenced climate change (IPCC 2007a: 5).

Observations of global mean temperatures have proved that 11 of 12 years between 1995 and 2006 (except 1996) have been the warmest on record since 1850 (IPCC 2007b: 36). The global mean temperature has increased by 0.76±0.19°C related to the periods from 1850-1899 to 2001-2005 (IPCC 2007b: 36). Furthermore, the 100-year warming trend between 1906-2005 with 0.74±0.18°C is higher than between 1901-2000 with 0.6±0.19°C due to the above mentioned temperature records (IPCC 2007b: 36).

In comparison between the linear warming trend over the last 100 years and the last 50 years, an increase from 0.074±0.026°C to 0.128±0.026°C represents almost a duplication of the mean temperature ascent. Additionally, the linear warming trend over the last 25-years is stated with 0.177±0.052°C (IPCC 2007b: 36-37) (see Figure 2).

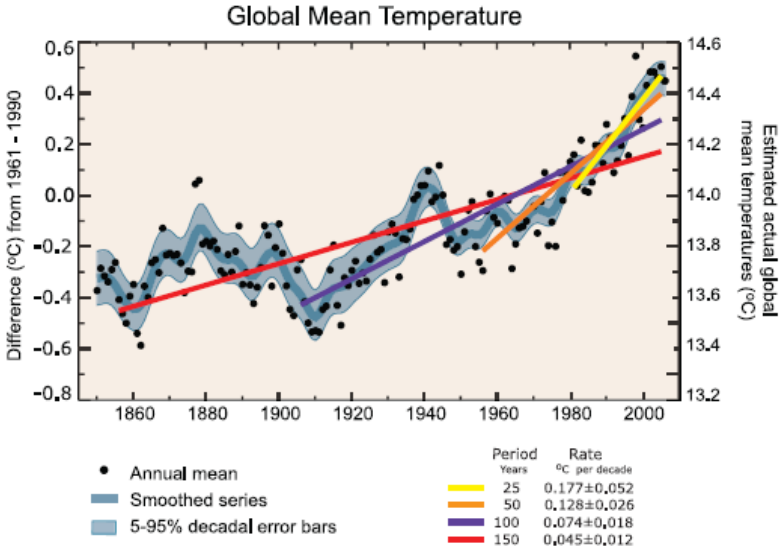

Figure 2: Global Mean Temperature (IPCC 2007b: 37)

[9] In the AR4 the term "very unlikely" is defined with the likelihood of the occurrence of <10% probability; "very likely" is defined with the likelihood of the occurrence of >90% probability (IPCC 2007b: 23) A table with IPCC-definitions of likelihoods is provided in Appendix V.

Different warming trends in the past two decades of 0.27°C per decade (land) and 0.13°C per decade (ocean) are observed while distinguishing between global land and global ocean mean temperature (IPCC 2007b: 37).

Heat waves have increased since the second half of the 20th century, according to a consistence between extremes of temperature and global warming (IPCC 2007b: 40). Changes in precipitation between 1900 and 2005 have been measured: the amount of precipitation has increased in the eastern parts of North and South America, northern Europe, northern and central Asia while a significant drying was observed in the Sahel, the Mediterranean, southern Africa and partly southern Asia (IPCC 2007b: 41). The global ocean temperatures (to depths of at least 3000m) have increased since 1961 due to an absorption of 80% of the anthropogenic added heat (IPCC 2007a: 5).

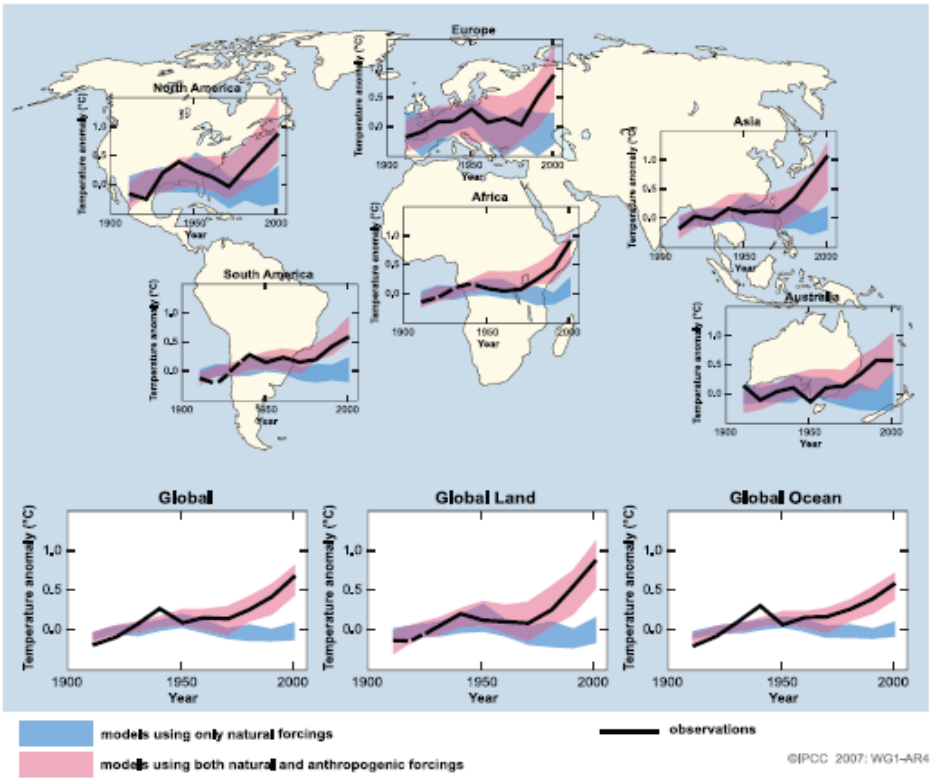

Figure 3: Global and Continental Temperature Change (IPCC: 2007b: 61)

Figure 3 displays results of models which approach continental temperature changes. These models distinguish between natural and anthropogenic or external forces such as human GHG emissions and are compared and overlaid with temperature observations. These models are applied on global land and global ocean temperature observations.

Mountain glaciers, snow cover and the ice sheets of Greenland and Antarctica have contributed melt water to sea level rise. Greenland's ice sheet is shrinking because the melting process has transcended the amount of snowfall. The sea level rise is stated with 1.8±0.5mm yr^{-1} between 1961 and 2005 but related to observations in short-term, the sea level rose in average 3.1±0.7mm yr^{-1} between 1993 and

2003 (IPCC 2007a: 5). The equilibrium climate sensitivity[10] is likely to be about 3°C [2-4.5°C] while a temperature increase below 1.5°C is very unlikely referring to climate response on radiative forcing (IPCC 2007b: 65). The projected temperature increases are coherent to equilibrium carbon dioxide equivalent (CO_2-eq) concentrations are displayed in Table 1.

Table 1: Model-Based Temperature Increases coherent to CO_2-eq Levels (IPCC 2007b: 66)

Equilibrium CO_2-eq (ppm)	Temperature Increase (°C)		
	Best Estimate	*Very Likely* Above	*Likely* in the Range
350	1.0	0.5	0.6–1.4
450	2.1	1.0	1.4–3.1
550	2.9	1.5	1.9–4.4
650	3.6	1.8	2.4–5.5
750	4.3	2.1	2.8–6.4
1000	5.5	2.8	3.7–8.3
1200	6.3	3.1	4.2–9.4

Future Climate Change Projections

The IPCC defined four emission scenarios in the IPCC "Special Report of Emission Scenarios" (SRES) (IPCC 2000) to approach anthropogenic future emission behavior. These models predict ranges of temperature changes and sea level rises for the 21st century, depending on the development of the global population, the economic growth, potential shifts towards global or local solutions and on the possible implementation of fossil-intensive or sustainable technologies (IPCC 2000: 3, 5). Climate policies (under the UNFCCC e.g.) are not included in the SRES emission scenarios (IPCC 2000: 3).

A brief summary of the scenarios is provided in Appendix III. Furthermore, quantitative ranges of the IPCC emission scenarios related to the time range of the 21st century are displayed in Appendix IV. In short-term ranges, the global mean temperature increases by 0.1°C per decade for the next two decades if the atmospheric concentration and respectively the radiative forcing remain on the level of the year 2000. Additionally, the sea level is projected to rise by 1.3±0.7mm yr^{-1} over the next several decades [IPCC 2007: 68)

In long-term ranges, the temperature increase is 1.8°C [1.1-2.9°C] at 2090-2099 relative to 1980-1999 projected with the low scenario (B1) while estimates for the high scenario (A1FI) describe a temperature increase of 4.0°C [2.4-6.4°C] based on SRES emission scenarios (IPCC 2007a: 13). The sea level rise is estimated in a range of 0.18-0.38m in a low scenario and in a range of 0.26-0.59m in a high scenario due to melting glaciers, ice covers and ice sheets (IPCC 2007) (see Table 2).

[10] The equilibrium climate sensitivity describes the response of the climate system on a doubling of the equivalent carbon dioxide concentration. Climate models, which partly simulate dynamic ocean behavior, estimate hence the range of the global surface temperature (IPCC 2007b: 131).

Table 2: Projected Temperature Change and Sea Level Rise in the 21st Century (IPCC 2007a: 13)

Case	Temperature Change (°C at 2090-2099 relative to 1980-1999)[a]		Sea Level Rise (m at 2090-2099 relative to 1980-1999)
	Best estimate	*Likely* range	Model-based range excluding future rapid dynamical changes in ice flow
Constant Year 2000 concentrations[b]	0.6	0.3 – 0.9	NA
B1 scenario	1.8	1.1 – 2.9	0.18 – 0.38
A1T scenario	2.4	1.4 – 3.8	0.20 – 0.45
B2 scenario	2.4	1.4 – 3.8	0.20 – 0.43
A1B scenario	2.8	1.7 – 4.4	0.21 – 0.48
A2 scenario	3.4	2.0 – 5.4	0.23 – 0.51
A1FI scenario	4.0	2.4 – 6.4	0.26 – 0.59

Table notes:
[a] These estimates are assessed from a hierarchy of models that encompass a simple climate model, several Earth System Models of Intermediate Complexity and a large number of Atmosphere-Ocean General Circulation Models (AOGCMs).
[b] Year 2000 constant composition is derived from AOGCMs only.

Oceans are going to acidify due to an increasing atmospheric CO_2 concentration. Therefore, by absorbing atmospheric CO_2, the global surface ocean pH is going to decrease between 0.14 and 0.35 units during the 21st century, while the global surface ocean pH has decreased of 0.1 units since pre-industrial times (IPCC 2007a: 14).

Warming is projected to be highest over land, at greatest over northern latitudes similar to the observed warming over the past decades (IPCC 2007a: 15). Snow cover is expected to shrink while the thaw depths in most permafrost regions are awaited to increase (IPCC 2007: 15). The IPCC furthermore describes an increase of frequent heat waves, hot extremes and heavy precipitation, while tropical cyclones are expected to become more intense with higher peak wind speeds and intensive precipitation (IPCC 2007b: 73-74). The meridional overturning circulation (MOC) is projected to slow down by 25% (IPCC 2007a: 16).

The Greenland ice sheet is projected to contract after 2100 and the melting ice will contribute to a sea level ice up to 7m (in relation to pre-industrial levels) if the Greenland ice sheet will melt completely (IPCC 2007b: 80).

Concluding, the IPCC states as “robust findings” that current CO_2 and CH_4 concentrations are higher than any levels during the past 650.000 years and fossil-fuel use, agriculture and land-use are the dominant anthropogenic sources for GHGs. Anthropogenic activities have influenced the net warming on climate since 1750 while solar irradiance’s influence on radiative forcing is relatively small in comparison to anthropogenic GHG emissions (IPCC 2007b: 81).

3.3.2 Impacts, Adaptation and Vulnerability (Working Group II)

Observations of Impacts on Natural and Human Environments

Temperature increases have an impact on regional natural systems. Physical and biological systems are affected by natural and anthropogenic influences on warming, but due to a better understanding of natural and human-induced drivers, it is very unlikely that exclusively natural causes have influenced these systems (IPCC 2007d: 28).

Impacts on physical systems by climate change are observed and can be related to specific regions. In regions with frozen ground and a ice and snow cover, an increasing instability of permafrost grounds, rock avalanches, enlargements of glacier lakes and hence the possible threat due to floods which are caused by an increasing disability of glacier lake damming moraines are stated by the IPCC (IPCC 2007d: 28). Impacts on sea ice biomes and food-chain predators in Arctic and Arctic Peninsula ecosystems are observed as well as emerging melting processes of Arctic and freshwater ice, alpine and Arctic Peninsula glaciers, snow and ice covers and permafrost soils (IPCC 2007d: 28). Earlier spring peak discharges and emerged run-offs have an impact on hydrological systems and affect the water quality and thermal structure of water systems due to ice melting processes (IPCC 2008c: 8). Sea level rise contributes to the loss of wetlands, mangroves and coastal areas (IPCC 2007d: 28).

Terrestrial biological systems respond to warming in several ways. Flora and fauna species shift polewards and elevational range shifts are observed while earlier leaf-unfolding, bird migration and egg-laying are in accordance with changes in the abundance of species in several regions due to climate change (IPCC 2007d: 28). A 10°-poleward shift of plankton, increases of zooplankton and algal populations in high-latitude and high-altitude lakes, earlier fish migration in rivers and stresses of coral reefs are further observed climate change impacts in marine and freshwater ecosystems (IPCC 2007d: 28).

Several impacts are stated for human environments. Agricultural and forestry activities have benefitted from a higher productivity due to longer growing seasons in northern latitudes, but a higher vulnerability as well as increasing forest fires or draughts in Northern America and the Mediterranean Basin have been observed as well (IPCC 2007d: 31).

The life of indigenous peoples is affected by migration changes of animals and plants in their livelihood besides climate change impacts on health (increasing morality in Europe, changes of human disease distribution and increasing productivity of allergic pollen in mid- and high latitudes of the northern hemisphere) (IPCC 2007d: 31).

Future Climate Change Impacts on Specific Sectors

Freshwater availability will increase by 10-40% in some wet-tropical areas and in high latitudes while a decreasing freshwater availability of 10-30% in mid latitudes and dry tropics is projected (IPCC 2007c: 11). The number of people who lives in stressed river basins will emerge from 1.4-1.6 billion in 1995 to 4.3-6.9 billion in 2050, according to the SRES A2 scenario. About 20% of the global population is

estimated to live in river basin areas by 2080, which are likely to be affected by flood hazards (IPCC 2007d: 35-36). 20-30% of the ecosystems' plant species are projected to be exposed to an increased risk of extinction due to a temperature increase of 1.5-2.5°C (IPCC 2007c: 11). These temperature increases will further disturb ecosystems' functions, the interaction of species and will decrease the biodiversity and subsequent reduce the amount of ecosystems' goods (IPCC 2007c: 11).

The resilience of many ecosystems is estimated to be transcended by 2100 due to climate change and climate change related disturbances (IPCC 2007d: 37) and the net carbon uptake of terrestrial ecosystems is projected to peak before during the mid of the 21st century what hence will accelerate global warming and disturb food chains in coral reefs e.g. due to progressing oceanic acidification (IPCC 2007c: 11).

Local mean temperature increases of 1-3°C in mid and high latitudes will increase the food productivity, but dry and tropical regions will suffer by an increasing hunger from a decreasing crop productivity of local mean temperature increases of 1-2°C (IPCC 2007d: 38). Coastal erosion and sea level rise are expected to represent increasing risks for coastal areas, low-lying areas and mega-deltas of Asia and Africa. Small islands are especially vulnerable due to limited adaptation possibilities (IPCC 2007c: 12).

Industrial activities, settlements and societies are positively or negatively affected by climate change on local scales but coherence between increasing negative impacts (additional costs e.g.) and increasing climate change is projected on absolute scale (IPCC 2007d: 41-43). Societies in areas which are vulnerable for extreme weather events (droughts, floods e.g.), societies in coastal areas or on small islands and poor communities especially in risk areas are projected to have increasing economic and social costs while the food and water resource availability decreases (IPCC 2007c: 12).

Especially societies with limited adaptation capacities are vulnerable to health-related issues while climate change affects the health status of millions (IPCC 2007d: 43). Low-income countries are projected to suffer the most from health impacts and therefore the adaptation potential of climate change related health issues and diseases (see Appendix VI) has to be improved (IPCC 2007d: 43).

Future Climate Change Impacts on Regional Scale

Africa is projected to be exposed significantly to climate change impacts and considered as the most vulnerable continent based on the current state of knowledge (IPCC 2007c: 13). Between 75 million - 250 million people are expected to suffer from decreasing water availability and a coexistent increasing water demand (IPCC 2007d: 48). Agricultural production, the lengths of growing seasons, harvest potentials and fishery earnings are estimated to decrease due to climate change (IPCC 2007c: 13). By 2100, 5-10% of the Gross National Product (GDP) is estimated to correspond for adaptation costs of low-lying and coastal areas, where large African population shares live (IPCC 2007c: 13).

As described above, melting water of Himalayan glaciers, floods in mega-deltas and sea level rise are projected to affect water availability, marine ecosystems and the livelihoods in Asia. Sustainable development in vastly growing urban areas in developing countries is expected to be negatively affected by climate change (IPCC 2007c: 13). Furthermore, by 2050, more than a billion people could

be affected by decreasing freshwater availability in coexistent increasing living standards (IPCC 2007d: 49). Crop productivity is projected to enhance by 20% in East and South-East Asia, while in Central and South Asia a decline of 30% is expected by the mid 21st century (IPCC 2007c: 13).

Australia and New Zealand are projected to partly face water security problems because of less precipitation by 2030 and significant biodiversity losses of important key ecosystems as the Great Barrier Reef and the Queensland Wet Tropics by 2020 (IPCC 2007c: 13; IPCC 2007d: 50). Regressions in agricultural and forestry production are expected except in some regions of New Zealand which benefit from longer growing seasons as well as from good infrastructural adaptation capacities (IPCC 2007d: 50).

In Europe, many impacts of climate change as retreating glaciers, population shifts and heat-related health risks e.g. can be stated (IPCC 2007d: 51). Southern Europe is projected to suffer from water shortages, droughts and wild fires while these threats are expected to become real to some extent in summer in Central and Eastern Europe (IPCC 2007c: 14). Significant losses of biodiversity, up to 60% of species in mountain communities (IPCC 2007d: 52)) are estimated due to limited adaptation capacities of species to global warming (IPCC 2007c: 14). Northern Europe partly will benefit from reduced heat costs and increasing growing seasons, but winter floods, the danger of extinction for certain flora and fauna species and increasing ground instability are negative impacts (IPCC 2007c: 14; IPCC 2007d: 51). Floods, increasing coastal erosion and frequent coastal floodings are projected impacts (IPCC 2007c: 14) while a high adaptation capacity is generally stated for Europe (IPCC 2007d: 53).

Gradual replacements of tropical forests by savanna in eastern Amazonia, desertification of agricultural land and significant biodiversity losses in tropical Latin America and changes from semi-arid to arid-land vegetation are expected impacts in Latin America (IPCC 2007c: 14). Decreasing water availability because of precipitation changes and retreating glaciers as well as increasing flooding risks and irreparable disadvantage of coral ecosystems are projected impacts of warming (IPCC 2007d: 53-54) while the adaptation capacity differs among the Latin American countries (IPCC 2007c: 14).

Northern American countries are expected to be influenced by increasing winter floods and decreased water flow in summer due to melting snow in the Western mountains, increasing pest, disease and wildfire risks in forests and stressed coastal communities due to the interaction of climate change, enhancing pollution and population growth (IPCC 2007c: 14-15; IPCC 2007d: 55). Heat waves in cities are projected to affect especially older people while a good adaptation capacity is stated due to a high level of infrastructure (IPCC 2007: 55).

Climate change impacts represent a severe challenge for human and natural environments in Polar Regions. Coastal erosions, retreat of ice thicknesses and partly melting permafrost soils are projected impacts for bird migrations, mammals and other predators. Therefore livelihoods of several species will shift and change the composition of ecosystems (IPCC 2007c: 15; IPCC 2007d: 56). The vulnerability of natural environments and human infrastructures (especially the livelihood of indigenous communities

(IPCC 2007d: 56)) is expected to increase although regional communities are developing adaptation strategies (IPCC 2007c: 15).

Small islands are highly vulnerable on sea-level rise, extreme weather events, coastal erosion and decreasing water availability by the 2050s (IPCC 2007c: 15). Therefore climate change affects strongly the livelihood of island populations, agricultural activities, regional fishing industries and coastal ecosystems by coral bleaching e.g. (IPCC 2007d: 57-58).

3.3.3 Mitigation of Climate Change (Working Group III)

Greenhouse Gas Emission Trends

Although many policies on energy security supply, climate change and sustainable development have been implemented, GHG emissions have increased from 28.7 to 49 $GtCO_2$-eq between 1970-2004 and have exceeded aims of adopted measures to stop the growth of GHG emissions (IPCC 2007e: 3). Weighted by the global warming potential (GWP), this represents an increase of 70% CO_2-eq. CO_2 emissions have increased by 80% and account for 77% of all GHG emissions in 2004; CH_4 emissions grew by 40% (mainly combustion and use of fossil fuel) and NO_x emissions by 50% (mainly use of agricultural use of fertilizers) (IPCC 2007e: 3; IPCC 2007f: 27). LLGHGs concentrations were about 455ppm CO_2-eq in 2005. Divided by sector, energy supply is responsible for 26% of global GHG emissions in 2004, industry for 19%, land use, land use change and forestry (LULUCF) for 17%, agriculture 14%, transport 13%, residual, commercial and service sectors for 8% and waste for 3% (IPCC 2007f: 27). Emissions from energy supply have grown by 145% between 1970-2004, emissions from industry by 120% and LULUCF emissions increased by 40% (IPCC 2007e: 3).

The energy intensity[11] decreased only by -33% in spite of the growth of the global per capita income of 77% combined with the global population growth of 69% (IPCC 2007e: 3). Annex I countries, which accounted for about 19.7% of the population, generated about 56% of the Gross Domestic Product based on Purchasing Power Parity (GDP_{PPP})[12] and were responsible for 46% of the global GHG emissions (IPCC 2007f: 30). These countries emitted 0.683 CO_2-eq/US$ GDP_{PPP} while non-Annex I countries generated 1.055 CO_2-eq/US$ GDP_{PPP} (IPCC 2007f: 31). Figure 4 describes the developing of different economic characteristics between 1970 and 2004.

In 2004, Annex I countries generated 16.1 t CO_2-eq per capita while non-Annex I countries emitted in average 4.2 t CO_2-eq per capita (IPCC 2007f: 31).

By 2030 emissions are expected to grow by 9.7Gt CO_2-eq to 36.7Gt CO_2-eq (25-90%) related to the emission levels of 1990, based on SRES emission scenarios and climate change policies in 2004. Annex I countries are expected to emit 9.1-15.1t CO_2 per capita by 2030 and therefore stay above the projected CO_2 per capita emissions of non-Annex I countries with 2.8-5.1t CO_2 per capita (IPCC 2007e:

[11] The energy intensity is the ratio of energy use and economic output, namely the Total Primary Energy Intensity (TPES) and the GDP_{PPP} (see Footnote 12) (IPCC 2007f: 100).

[12] GDP_{PPP} is a preferred metric to express income comparisons of countries, which are on (very) different development stages (IPCC 2007e: 6).

4). Additionally, the energy intensity is expected to be higher in non-Annex I countries (11.0-21.6 MJ/ US$ GDP) than in Annex I countries (6.2-9.9 MJ/US$ GDP) (IPCC 2007e: 4).

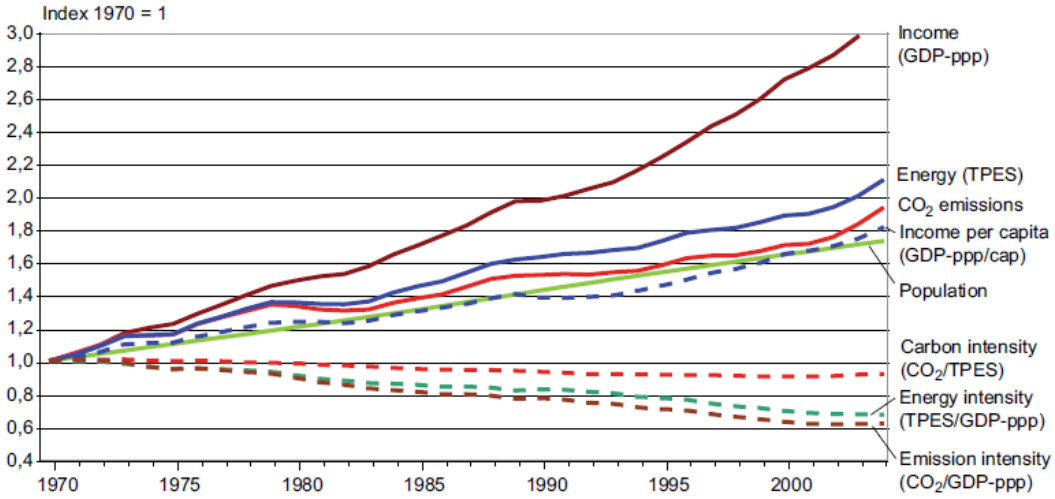

Figure 4: Development of Different Economic Characteristics Between 1970 - 2004 (IPCC 2007e: 5)

Short and Mid-Term Mitigation Options

A *"substantial economic potential for the mitigation of global GHG emission over the coming decades"* (IPCC 2007e: 9) is stated by the IPCC after assessing bottom-up[13] and top-down[14] studies of climate change mitigation.

Bottom-up studies indicate an emission reduction potential of approximately 6Gt CO_2-eq per year with net negative costs[15] (IPCC 2007e: 9).

Table 3: Mitigation Potentials of Global CO_2-eq Emissions (Bottom-up studies) (IPCC 2007e: 9)

Carbon price (US/tCO_2-eq)	Economic potential ($GtCO_2$-eq/yr)	Reduction relative to SRES A1 B (68 $GtCO_2$-eq/yr) (%)	Reduction relative to SRES B2 (49 $GtCO_2$-eq/yr) (%)
0	5-7	7-10	10-14
20	9-17	14-25	19-35
50	13-26	20-38	27-52
100	16-31	23-46	32-63

[13] Bottom-up models/studies first analyze specific characteristics of processes on microeconomic level (technologies, costs e.g.) before statements on macroeconomic level are given (IPCC 2007f: 96).

[14] Top-Down studies/models first characterize macroeconomic environments and analyze related data (prices, income, consumption e.g.) before specific statements about microeconomic processes are given (IPCC 2007f: 107).

[15] Benefits of options with net negative costs equal or exceed social costs (reduced energy costs e.g.) but benefits for avoided climate change impacts are not included (IPCC 2007e: 9).

Depending on the carbon price[16], economic and CO_2-eq yr^{-1} reduction potentials related to the SRES A1 and B2 scenarios are allegorized in Table 3.

The economic potential emerges with an increasing carbon price related to bottom-up studies. Top-down studies qualitatively arrive at the same conclusion though with different quantified economic potentials.

Therefore both economic approaches present reduction potential ranges due to limited information about the degree of implantation in countries or sectors (IPCC 2007e: 9). Table 4 shows the projected economic potential from top-down studies:

Table 4: Mitigation Potentials of Global CO_2-eq Emissions (Top-down studies) (IPCC 2007e: 9)

Carbon price (US/tCO_2-eq)	Economic potential ($GtCO_2$-eq/yr)	Reduction relative to SRES A1 B (68 $GtCO_2$-eq/yr) (%)	Reduction relative to SRES B2 (49 $GtCO_2$-eq/yr) (%)
20	9-18	13-27	18-37
50	14-23	21-34	29-47
100	17-26	25-38	35-53

Bottom-up studies describe the possible CO_2-eq yr^{-1} reduction potentials by sector if the carbon price is below 100US$/t CO_2-eq: Energy supply 2.4-4.7Gt CO_2-eq yr^{-1}, Transport 1.6-2.5Gt CO_2-eq yr^{-1}, Buildings 5.3-6.7Gt CO_2-eq yr^{-1}, Industry 2.5-5.5Gt CO_2-eq yr^{-1}, Agriculture 2.3-6.4Gt CO_2-eq yr^{-1}, Forestry 1.3-4.2Gt CO_2-eq yr^{-1} and Waste 0.4-1Gt CO_2-eq yr^{-1} (IPCC 2007e: 11), which is in total 19.4-31Gt CO_2-eq yr^{-1}.

The IPCC furthermore defines key mitigation technologies and actions whose implementations are necessary to tap the full economic potential. These climate change mitigation options are divided by sector and date of their commercial availability (currently or before 2030) and are listed in Appendix VII. 0.06 to 0.12 percentage points of the annual average GDP by 2030 are estimated to equal the global economic costs to stabilize the CO_2-eq levels in long-term (IPCC 2007e: 12) and, according to the ppm CO_2-eq stabilization levels (see Table 1), to limit the temperature increase at a certain level (see Table 5).

Table 5: Macroeconomic Costs for Different ppm CO_2-eq Stabilization Levels (IPCC 2007e: 12)

Stabilization levels (ppm CO_2-eq)	Median GDP reduction[d] (%)	Range of GDP reduction[d], [e] (%)	Reduction of average annual GDP growth rates[d], [f] (percentage points)
590-710	0.2	-0.6-1.2	<0.06
535-590	0.6	0.2-2.5	<0.1
445-535[g]	not available	<3	<0.12

Macroeconomic costs for CO_2-eq mitigation are therefore estimated as a reduction of 3% of global GDP for a stabilization level at 445ppm CO_2-eq. A small increase of 0.6% of global GDP is projected for a

[16] Carbon price: Price per ton of avoided CO_2-eq or the costs for actions to neutralize one ton of CO_2-eq that have to be paid as a tax or as an emission permit exchange (IPCC 2007f: 97).

stabilization level at 710ppm CO_2-eq by 2030 (IPCC 2007e: 12).

Long-Term Mitigation Options – Measures and Instruments

The IPCC further assessed climate change mitigation options in long-term by 2050. Six CO_2 and CO_2-eq stabilization level ranges (scenarios or categories) are defined between 350-790ppm CO_2 or rather 445-1130ppm CO_2-eq. Furthermore, the category-related ranges of radiative forcing, global mean temperature increase, emission peaking and necessary change in global CO_2 emissions by 2050 (related to the baseline year 2000) describe quantified the consequences of different long-term climate policy scenarios (see Table 6).

Table 6: Long-Term Climate Change Mitigation Scenarios (IPCC 2007e: 15)

Category	Radiative forcing (W/m^2)	CO_2 concentration[c] (ppm)	CO_2-eq concentration[c] (ppm)	Global mean temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity[b], [c] (°C)	Peaking year for CO_2 emissions[d]	Change in global CO_2 emissions in 2050 (% of 2000 emissions)[d]	No. of assessed scenarios
I	2.5-3.0	350-400	445-490	2.0-2.4	2000-2015	-85 to -50	6
II	3.0-3.5	400-440	490-535	2.4-2.8	2000-2020	-60 to -30	18
III	3.5-4.0	440-485	535-590	2.8-3.2	2010-2030	-30 to +5	21
IV	4.0-5.0	485-570	590-710	3.2-4.0	2020-2060	+10 to +60	118
V	5.0-6.0	570-660	710-855	4.0-4.9	2050-2080	+25 to +85	9
VI	6.0-7.5	660-790	855-1130	4.9-6.1	2060-2090	+90 to +140	5
						Total	177

Macroeconomic long-term approaches describe constant reductions of annual GDP growth rates with 0.12 to 0.05 percentage points in 2050 depending on the stabilization level of 445ppm to 710ppm CO_2-eq. The range of GDP reduction is stated with 5.5% for a stabilization level of 445ppm CO_2-eq and with an increase of 1% for GHG stabilization at 710ppm CO_2-eq (IPCC 2009e: 18). National climate policies to mitigate climate change are widespread available and *"well or poorly, stringent or lax [designed]"* (IPCC 2007e: 19) depending on their environmental effectiveness, cost effectiveness, distributional effects and institutional feasibility (IPCC 2007e: 19). Therefore, the IPCC describes different policy measures and instruments to mitigate climate change effectively: stimulation for investments in low-carbon products/ technologies if a carbon price is defined (IPCC 2007e: 9), governmental financial support (contributions, tax credits, standard setting and market creation) for technical innovative development and further technology transfer to developing countries (IPCC 2007e: 20), establishment of additional mechanism on national or international level (carbon markets) under the Kyoto Protocol or future UNFCCC agreements (IPCC 2007e: 21) and potentials to reduce GHG emissions through international cooperation (IPCC 2007e: 21). Environmental effective mitigation policies by sector are provided in Appendix VIII.

4. The Kyoto Protocol (COP 3)

COP 3 adopted the Kyoto Protocol with decision 1/CP.3 on December 11th, 1997 as an additional protocol to the UNFCCC in accordance with Article 2 of the Convention (see 2.2.1) (UNFCCC 2006: 72). More than 10000 participants, including representatives of 155 parties and 6 observer states as well as 278 observer organizations (UNFCCC 1997a), joined the COP 3 in Kyoto, Japan. The Kyoto negotiations, officially held between December 1st and 10th, 1997, are often described as very dynamic, chaotic and confusing (Treber 1998; Bettelli et al. 1997: 14-15), but the first concrete and binding emission reductions were agreed after enlarging the negotiations of COP 3 until the noon of the 11th December (Bettelli et al. 1997: 14). Further negotiations during COP 4 in Buenos Aires (whose outcome was the Buenos Aires Plan of Action (BAPA) (UNFCCC 1998:4)), COP 6 in Den Haag / Bonn and COP 7 in Marrakesh (which ended with the Marrakesh Accords (UNFCCC 2001)) clarified technical aspects under the Kyoto Protocol.

The Kyoto Protocol regulates GHG emissions of industrialized countries and consists of 28 articles and two Annexes. GHGs listed in Annex A of the Kyoto Protocol are CO_2, CH_4, nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) (UNFCCC 1997b: 19) and Annex B lists Annex I countries that are obligated to reduce these emissions in average by "*at least 5 per cent below 1990 levels in the commitment period 2008 to 2012"* (UNFCCC 1997b: 3). These emission reductions differ from country to country, because different economic developments are taken into account. Therefore the countries with economics in transition (EITs), due to the allowed certain degree of flexibility (see 2.3.1), and some other Annex B countries are able to increase their emissions, while the European Community is obligated to reduce their emissions by 8% e.g. (UNFCCC 1997b: 4, 20; see Appendix IX). Countries are furthermore obligated to monitor and report their emissions as a national GHG inventory to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) (UNFCCC 1997b: 6). The development of GHG emissions between 1990 and 2007 (excluding LULUCF) of Annex B Parties is listed in Appendix X.

The Kyoto Protocol came into force on February 16th, 2005, 90 days after the ratification of Iceland, because the condition that "*55 Parties to the Convention, […] which accounted in total for at least 55 per cent of the total carbon dioxide emissions […] have deposited their instruments of ratification*" (UNFCCC 1997b: 18) was fulfilled. The USA –at that time biggest GHG emitting country – did not ratify the Kyoto Protocol under the Presidency of George W. Bush Jr. though Al Gore, Vice President and lead negotiator of the USA at COP 3, gave the signatory to the Kyoto Protocol (McCright et al. 2003: 26; Bettelli et al. 1997: 15). The USA remained the only industrialized country which has not ratified the Kyoto Protocol after the ratification of Australia under the Prime Minister Kevin Rudd in 2007, (Reuters 2007).

Flexible mechanisms as International Emission Trading (IET), Joint Implementation (JI) and the Clean Development Mechanism (CDM) are established under the Kyoto Protocol to alleviate Annex B countries to achieve their quantified emission limitation and reduction objectives (QELROs) without high

socio-economic costs by implementing these mechanisms optionally into national policies. Furthermore these market-based instruments should offer flexible incentives for developed countries and private sectors to invest in sustainable development and low-emission technologies and for developing countries to collaborate concerning emission reductions (UNFCCC 2010c).

4.1 International Emission Trading (IET)

Ronald H. Coase developed the Coase theorem in 1960 which described the diverging of social and private costs of an action due to inefficient allocation of resources on markets.

Actions of A could represent negative external effects for B, although it will be assumed that they are not in direct market concurrence. Coase made the case that market participants (A and B) solve external problems efficiently, if these participants are able to dispose allocations of resources and to trade these resources without costs (Enderle et al. 1999). Coase described external effects as property rights (equivalent to the valuable difference of social and private costs), assumed that external effects appear reciprocal (Coase 1960: 1, 5) and are owned by the market participant with the highest interest in this resource (Enderle et al. 1999). He furthermore concluded that direct negotiations of market participants (A and B) will lead to pareto-efficient and optimal macroeconomic results, even if external effects influence the market (Coase 1960: 8).

The Canadian economist J.H. Dales transposed the Coase theorem on a market for pollution rights to limit the water pollution by industrial emissions (Dales 1968: 12-15, 17). Therefore policy-makers are able to define directly threshold values for pollution limits and every unit of pollution can be traded on a market for a market-generated price (Dales 1968: 21-23).

The Kyoto Protocol establishes international emission trading (IET) (cap and trade) for Annex B countries in Article 17 *"supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments"* (UNFCCC 1997b: 15). The collective target level is defined as "cap" while emission savings of mitigation options with lowest reduction costs generate tradable emission rights (trade). Therefore investments on carbon markets are focused on the most cost-effective mitigation option (Duerr 2007: 3) As described above, Annex B countries are obligated to reduce their emissions by a certain amount (based on 1990-levels) under the Kyoto Protocol – vice versa, the amount of left over emissions can be considered as pollution rights and is expressed as assigned amount units (AAUs) under the Kyoto Protocol – one AAU equals one metric ton of CO_2-eq (UNFCCC 2006b: 3). AAUs can be traded on as a commodity on a so-called carbon market, but countries are obligated not to *"drop below 90 per cent of the Party's assigned amount […] or 100 per cent of five times its most recently reviewed inventory, whichever is lowest*" (UNFCCC 2006b: 19). These commitment period reserves (CPRs) are implemented to ensure that countries do not oversell their AAUs and therefore fail their emission reduction target (UNFCCC 2008: 58). If Party A reduces its emissions below its emission cap, Party A can sell the left over amount of AAUs (difference between the cap and the real emissions) on a carbon market to Party B, who emits more GHGs than allocated and therefore needs to buy additional AAUs. Party B will buy additional AAUs, if the costs are lower

than the costs for the implementation of less-GHG-emitting technologies. The measures for Annex B countries of the Kyoto Protocol to achieve their collective emission cap are therefore the most cost-efficient on macroeconomic scale, according to the theoretical approach of Coase (Mizuno 2009: 4). If an Annex B country fails to meet its emission cap, the 1.3-fold amount of exceeded emissions will be subtracted from the AAUs of the following commitment period, the country is forced to develop an compliance plan and is excluded from IET under Article 17 of the Kyoto Protocol (Mizuno 2009: 5).

4.2 Joint Implementation (JI)

The project-based or crediting mechanism Joint Implementation (JI) is established under the Kyoto Protocol in Article 6 (UNFCCC 1997: 6-7). Annex B countries can transfer or acquire projects of emission reduction technologies to or from another Annex B country. The Annex B Party who invests in one of these projects gains emission reduction units (ERUs) which equal the amount of reduced emissions compared to a baseline scenario (UNFCCC 2010d). One ERU is equivalent to one metric ton of CO_2-eq (UNFCCC 2006b: 3). The Joint Implementation mechanism is generally divided into two different so-called "Tracks". A Party can apply JI Track I, which represents a simplified project verification process, if it fulfills all criteria of the JI Guidelines, according to Paragraph 23 of the eligibility requirements (UNFCCC 2010e). The country hosting the JI project (host Party) is allowed to verify the JI project and to define the amount of ERUs (UNFCCC 2006b: 7) if it fulfills all the above mentioned criteria. These countries can choose between applying JI Track I or JI Track II, but countries that fulfill just certain criteria of the eligibility requirements have to apply JI Track II, which is supervised by the Joint Implementation Supervisory Committee (JISC) under the CMP (UNFCCC 2010e).

The implementation of JI Track II projects is divided in the project development and the project operation phase. A designed project, which is approved by the host Party, has to be examined by an accredited independent entity (AIE)[17] and finally accredited by the JISC, which decides on base of the AIE report. During the project operation, the project developer has to monitor the emission reductions, which are verified by the AIE and approved by the JISC. Finally the host Party issues the verified ERUs to the project developer (UNFCCC 2006b: 9-11).

4.3 Clean Development Mechanism (CDM)

The Clean Development Mechanism (CDM) represents a project-based or crediting mechanism as well as JI but with significant differences. CDM is established under Article 12 of the Kyoto Protocol "*to assist Parties not included in Annex I in achieving sustainable development and […] compliance with their quantified emission limitation and reduction commitments"* (UNFCCC 1997: 11). Annex B Parties under the Kyoto Protocol can generate certified emission reductions (CERs) by implementing emission reduction projects in non-Annex B (or developing) countries (UNFCCC 2010g). One CER is equivalent, as one AAU or ERU, to one metric ton of CO_2-eq (UNFCCC 2006b: 3). Generally it has to be

[17] AIEs are as of May 2010: TÜV SÜD Industrie Service Gmbh, SGS United Kingdom Ltd., Bureau Veritas Certification Holding SAS, Det Noprske Veritas Certification AS (DNV) (UNFCCC 2010f)

distinguished between CER, temporary CER (tCER) and long-term CER (lCER). CERs are generated through sustainable development of technological projects while tCERs and lCERs are generated through afforestation and reforestation CDM projects (Mizuno 2009: 5) and are not going to be further considered here.

Projects, which are designed by an Annex B Party, have to be registered by the CDM Executive Board (CDM EB). The project developer firstly has to set a hypothetical baseline scenario to prove that this project will lead to emission reductions in long-term and to define the measurable amount of emission reductions (UNFCCC 2010g). A designated national authority (DNA) of each Party involved (including the project hosting party) has to approve the project on national level (Mizuno 2009: 6; UNFCCC 2010h). Subsequent a designated operational entity (DOE) has to verify this project and to report to the CDM EB (UNFCCC 2006b: 15; UNFCCC 2010ih). The CDM EB decides if the project will be approved (registered) and issues the amount of generated CERs in a formal procedure (Mizuno 2009: 6). Projects are divided into small scale (less than 15MW or 15MW-eq installed capacity) (UNFCCC 2006c: 43) or large scale projects. The same DOE is allowed to validate and verify a small scale project and certificate the generated CERs according to simplified guidelines, which are established for small scale projects (UNFCCC 2010j). Therefore the CDM EB is only responsible for large scale projects (installed capacity above 15MW or 15MW-eq). By November 2009, 315 million CERs have been generated through the CDM mainly in China (47.03% of all CERs) and in the energy sector (60.35% of all projects), the waste handling and disposal sector (17.61%) and agriculture (5.29%) (UNFCCC 2009b: 1). Asia has been the major hosting region (74.04% of all projects) followed by Latin America and the Caribbean (23.49%) while the UK and Northern Ireland (28.49%) and Switzerland (20.72%) invested the most in CDM projects (UNFCCC 2009b: 17-18).

Annex B countries are allowed to add generated CERs through CDM projects and ERUs through JI projects to their emission cap. The emission cap of an Annex B Party under the Kyoto Protocol is therefore defined as (Mizuno 2009: 5):

$$\text{Cap} = \text{AAUs} + \text{RMUs}^{18} + \text{CERs} + \text{tCERs} + \text{lCERs} + \text{ERUs} \pm \text{acquired/transferred AAUs} \qquad (1)$$

4.4 The European Union Emission Trading Scheme (EU ETS)

The European Union Emission Trading Scheme (EU ETS) represents the first multinational and multi-sectoral GHG emission trading system which is based on the EU Directive 2003/87/EC "*to promote reductions of greenhouse gas emissions in a cost-effective and economically efficient manner"* (EU 2003: 33). The member countries of the European Union (EU) emitted 4.233Gt CO_2-eq in 1990 and 4.052Gt CO_2-eq in 2007 excluding LULUCF (UNFCCC 2009a: 16) which equals a decrease of 4.3%. The EU is obligated to reduce 8% of its emissions by 2012 (based on 1990-levels) but, due to the

[18] A removal unit (RMU) equals one metric ton of CO_2-eq (UNFCCC 2006b: 3) and is generated through LULUCF projects (Mizuno 2009: 5), because afforestation and reforestation activities influence the carbon sink potential of national forest lands, cropland, grasslands, wetlands, settlements and other lands (UNFCCC 2010k).

burden sharing agreement[19], the emission rights (caps) are distributed individually or differentiated among the EU member countries (Duerr 2007: 6).

The total emission budget is distributed between different GHG emitting sectors as energy and industry (macro allocation) and finally the emission rights are given to the market participants in these sectors (Duerr 2007: 3). The European Commission estimates costs of the EU ETS annually with 2.9-3.7 billion € and costs without the ETS with 6.8 billion € (EU 2006: 7). The EU ETS became effective in January 2005, but the first phase in 2005-2007 was considered as a pilot-phase. Mandatory National Allocation Plans (NAPs) of EU member countries contain distribution rules. Distributed free of charge emission rights, less transparency about emission right availability on the carbon market, 44 million CO_2-certificates more available than needed on the market, CO_2 as the only tradable GHG and 25 complex national legislations have to be stated as drivers for inefficient outcomes (Duerr 2007: 7-9).

The allocation of CO_2-certificates in the second trading period in 2008-2012 (in accordance with the first Kyoto commitment period) is more restricted and only 2.08 billion certificates are distributed (EU GHG emission levels equivalent to 6.5% below 2005-levels) with a trading limit of 10% of all certificates (EU 2008: 8; Duerr 2007: 10). Furthermore, emission reduction units (ERU) from Joint Implementation (JI) or Clean Development Mechanism (CDM) projects can be included with a maximum share of 22% in national emission budgets. Civil aviation companies are obligated to buy emission certificates beginning in 2011, which are directly allocated by the Commission based on the best available technology (BAT) principle (Duerr 2007: 12; EU 2008: 8, 13)

The third trading period will take place in 2013-2020 and contains some substantial changes compared to the first and second period. This period was enlarged to provide good market conditions for investments in emission reductions due to a greater predictability of market-intern events as decided caps or the availability of certificates (EU 2008: 8). The community-wide cap is defined with 1.79Gt CO_2 in 2013 and will be continuously reduced by 1.74% annually to 1.72Gt CO_2 in 2020 (EU 2009: 63-64). This represents a reduction of 20% compared to 1990-levels (EU 2009: 64) in accordance with the EU's 20-20-20-target (EU 2008a). N_2O and haloalkanes are included in the ETS; the allocation of free of charge emission certificates is based on the BAT principle (benchmarking mechanism) and not on the comparison of historical emissions (grandfathering principle). Energy-intensive companies, which belong to the 10%-environmental-friendliest in their sector, gain free of charge emission certificates (EU 2009: 70, 72-75, 85). The guidelines for the third trading period contain further uncertainties as to which extend borrowing (of future trading period certificates) or banking (of former trading period certificates) mechanisms are implemented and how or if emissions from carbon capture and storage (CSS) plants are integrated into the EU ETS (Duerr 2007: 14).

[19] Burden sharing is established in the Kyoto Protocol under Article 11 (UNFCCC 1997b: 10-11) for the EU. Annex B countries are allowed to apportion their commitments among each other.

5. The Bali Road Map (COP 13)

The Bali Roadmap was adopted during the final sessions of COP 13 in Bali on December 15th, 2007 (Appleton et al. 2007: 1, 19) for long-term cooperation in a post-2012 emission reduction framework "*to achieve the ultimate objective of the Convention"* (UNFCCC 2007b: 3). The COP 13 and CMP 3 negotiations represented the beginning of an implemented two-year process to establish substantial measures for a subsequent commitment period of the Kyoto Protocol, which should be finalized by 2009 on COP 15/MOP 5 (Appleton et al. 2007: 15; UNFCCC 2007b: 3). The COP has defined this process as a "*comprehensive process to enable the full, effective and sustained implementation of the Convention through long-term cooperative action, now, up to and beyond 2012* [with the purpose to] *reach an agreed outcome and adopt a decision at its fifteenth session*" (UNFCCC 2007b: 3).

The Bali Action Plan (BAP), the most notable outcome of COP 13 and adopted with decision 1/CP.13 (UNFCCC 2007b: 1, 3), is the key component of the Bali Roadmap and contains qualitative building blocks (see below) (Appleton 2007: 15). The BAP furthermore refers to the IPCC AR4, which defines a 10-40% GHG cut by 2020 and a 40-95% GHG cut by 2050 of developed countries for a low to medium GHG stabilization level (450-550ppm CO_2-eq) (IPCC 2007f: 90) by recognizing that "*deep cuts in emissions will be required"* (UNFCCC 2007b: 3).

During COP 13 the Parties under the Convention have obligated themselves to design a legally binding post-2012 framework to address climate change by 2009. The quality and the degree of implementation of the Bali Roadmap strongly depend on post-COP 13 working group negotiations ("on the road to Copenhagen"), COP 14 and especially COP 15 negotiations itself.

The first building block under the BAP represents a "*shared vision for long-term cooperative action, including a long-term global goal for emission reductions*" (UNFCCC 2007b: 3) according to the principles of the Convention. Therefore this building block details the above mentioned comprehensive process and defines that a multilateral binding agreement for long-term climate change strategies should represent the outcome of this working process by 2009.

The second building block describes that developed country parties should define *"[m]easurable, reportable and verifiable nationally appropriate mitigation commitments or actions, including quantified emission limitation and reduction objectives"* (UNFCCC 2007b: 3) and including national actions to support and enable "*sustainable development […] by technology, financing and capacity-building*" (UNFCCC 2007b: 3). Furthermore developed countries should consider "*[p]olicy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries*" (UNFCCC 2007b: 3) as well as cooperation in sectors and on sector-specific topics (UNFCCC 2007b: 4). Market opportunities for cost-effective climate change mitigation should be taken into account as well as *"[e]conomic and social consequences of response measures*" (UNFCCC 2007b: 3) in future actions of developed countries (UNFCCC 2007b: 4) while "*synergies among activities and processes […] in a coherent and integrated manner*" (UNFCCC 2007: 4) should represent the basis of cooperation to achieve climate change mitigation.

The third building block under the BAP refers to adaptation of climate change and lists various adaptation actions to address "*the urgent and immediate needs of developing countries that are particularly vulnerable to the adverse effects of climate change*" (UNFCCC 2007b: 4). Developed countries should cooperate internationally "*to support urgent implementation of adaptation actions*" (UNFCCC 2007b: 4). Risk management including a transfer mechanism (insurance), disaster reduction strategies concerning *"loss and damage associated with climate change impacts in developing countries"* (UNFCCC 2007b: 4) and resilience through economic diversification represent key elements of climate change adaptation, which should be supported *"in a coherent and integrated manner"* (UNFCCC 2007b: 4)

Technology development and technology transfer are contained in the fourth building block. *"Effective mechanisms"* should represent incentives for developed countries "*to promote access to affordable environmentally sound technologies*" (UNFCCC 2007b: 4) for developing countries by developing and transferring technologies. Therefore strategies "*to accelerate deployment, diffusion and transfer*" [and for "[c]*ooperation on research and development"* (UNFCCC 2007b: 4-5) of environmental friendly technologies should be considered as well as the effectiveness of technology transfer mechanisms (UNFCCC 2007b: 5).

The fifth building block contains provisions for financial funding. Developing countries should get "*[i]mproved access to adequate, predictable and sustainable financial resources and financial and technical support"* (UNFCCC 2007b: 5). This "*official and concessional funding"* (UNFCCC 2007b: 5) should assist developing countries for handling climate change impacts, guarantee sustainable development in developing countries in context of adaptation and mitigation, offer incentives for public and private sectors of developing countries to capital *"climate-friendly investments"* (UNFCCC 2007b: 5) and to support the adaptation and capacity-building of vulnerable countries (UNFCCC 2007b: 5).

The above described building blocks are established under the BAP as well as the implementation of the Ad Hoc Working Group on Long-Term Cooperation (AWG-LCA) (UNFCCC 2007b: 5) to conduct the negotiations on an independent "*two track-approach*" (Appleton et al. 2007). Therefore the comprehensive (climate change negotiations) process is divided into two working groups:

- Ad Hoc Working Group on Long-Term Cooperation (AWG-LCA)

The during COP 13 established AWG-LCA focuses on negotiations to convert the BAP building blocks into an agreed outcome which should be adopted at COP 15 (UNFCCC 2008a: 2). The AWG-LCA has met for eight times including its meetings at COP 15 (UNFCCC 2010l).

- Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP)

The in 2005 established AWG-KP focuses on negotiating emission reduction commitments and the design of mechanisms for a post-2012 commitment period (UNFCCC 2006d: 2).

Empirical Part

The empirical part of this thesis contains a literature analysis, in which it will be distinguished between three different groups of climate experts who are involved in the COP 15 negotiations and their positions concerning necessary COP 15 outcomes. The results of this analysis will be compared with the outcome of COP 15 to evaluate, if or to what extend the conference can be considered as successful or pathbreaking for addressing climate change and to promote and accelerate sustainable development.

Originally, a questionnaire survey should have represented the empirical part. The questionnaire (see Appendix XIII) was designed to analyze climate experts' opinions and expectations concerning the necessary outcome of COP. This survey has been carried out in advance and during COP 15, but due to a small amount of samples, the results cannot be considered as representative. Therefore the conclusion of this survey is summarized briefly and included at the beginning of the empirical part of this Bachelor's Thesis. It should be considered as a qualitative starting point for the subsequent analysis of three different approaches to a post-2012 framework without an influencing character.

Starting Point – Conclusion of COP 15 Questionnaire Survey

The global mean temperature increase should be limited. The majority of the answers state that average global warming should not exceed 1.5-2°C. Therefore a GHG stabilization level of 350-450 ppmv CO_2-eq is necessary. Furthermore the value of world average CO_2-eq emissions by 2050 should not exceed 2 tones per capita and year, but several interviewees stated that lower world average CO_2-eq emissions by 2050 (1 ton or 1.5 tones) are necessary for long-term mitigation. The question whether to limit global warming at 1.5°C or 2°C is an ethical and political, referrers to the projected impacts (see 3.3.2) and the long-term mitigation scenarios of the IPCC (see 3.3.3) and should be considered in the understanding, which climate change impacts are acceptable.

To limit global warming, all interviewees see the necessity of a multilateral binding treaty with concrete emission targets by 2020 as the outcome of COP 15. A majority considers this treaty in a future action framework by 2020 including a covenant for a developing fund (in addition to World Bank programs) while few interviewees see the necessity of a implemented long-term action, in particular concrete emission targets by 2050. Furthermore, a big part of the interviewees think that industrialized countries should reduce 40% of their emissions by 2020 while a majority stated a 80-100% necessary GHG emission reduction by 2050 (both based on 1990-levels). A majority of the interviewees think the participation of U.S. President Obama on COP 15 is very important, because he represents the biggest GHG emitting Annex I country. It was not clear in advance of COP 15, if Obama would join the negotiations, because his decision was based on the status of the pre-COP 15 negations (New York Times 2009). The influence of the U.S. Climate Act "The Cap and Trade Bill HR 2454" on COP (if it would have passed the U.S. Senate in advance of COP 15) are evaluated differently. Some interviewees considered it as a positive signal to the COP - others think it is not ambitious enough and it

will "*encourage more counterproductive carbon trading schemes*". The Act did not pass the Senate; therefore the U.S. delegation was just able to put a 17% emission reduction by 2020 based on 2005-levels on the table (US Dept. of Energy 2009). The opinions differ about, if and how non-Annex I countries should be included in a post-2012 framework by 2020. Several interviewees think non-Annex I countries should focus on developing performance; some think they should present emission reductions until 2020 or "*have binding goals but large enough to allow space for development*" with "*the help provided by Annex1 countries*". The majority of the interviewees stated that non-Annex I countries should be included in emission reductions by 2050, but not before Annex I countries have obligated themselves for substantial emission reductions. Furthermore it should be distinguished between "*the country and the class within the country*". The LDCs should have the chance to develop under a post-2012 framework. A bigger part of the interviewees think that LDCs should be taken out of emission reductions by at least 2020 while some think LDCs should be taken out of emission reductions by 2050.

Opinions about financial mechanisms in a post-2012 framework differ significantly. The CDM is considered as an effective instrument to mitigate climate change ("*CDM is an on-ramp for countries that cannot yet implement domestic emission trading to participate in the global market and build institutional capacity for future carbon markets"*) as well as a mechanism for "green-washing" of national eco assessments ("*CDM is a smokescreen and helps Annex1 countries to keep on the polluting path").*

Opinions about the design of future carbon markets differ as well (current systems or additional or new designed markets). Especially the infectivity is of current systems is emphasized ("*Current institutions & organizations with a renewed governance structure*"; "*Domestic policies and potentially a revisited emissions trading system*"). Indeed the majority prefers a cap and trade system but some interviewees stated the infectivity of current systems: "*Carbon trading system may not be very effective, but we seem to be stuck with it (path dependency…)*" and "*Carbon Trading is in its current form fundamentally flawed. Especially offsetting is damaging*". One interviewee sees an *"[enforcing] institutional capacity to implement*" while another interviewee disapproves carbon trading completely: "*Carbon trading should be abolished immediately [and] is harmful to climate stability and cannot be reformed; No Carbon Trading".* A majority sees a necessary annual financial flow in a range of more than 60 billion US$ by 2020 and more than 90 billion US$ by 2050 to developing countries while two interviewee stated that "*Developing countries need at least 100 [billion] € annually for mitigation, adaptation and technological transfer*" and "*Don't leave developing countries out of the Cap and Trade. But give them a big enough allowance*." Most of the interviewees see CSS as a wrong thinking on the way to a low carbon society but some think it should be further researched due to a lot of uncertainties.

Concluding, the most important issues for COP 15 are the quantified limitation of global warming, the therewith linked necessary GHG stabilization levels, the legal status of the outcome and the agreed binding emission reductions of Annex I countries, the degree of implementation of flexible mechanisms and requirements for the mechanisms' effectiveness, the role of non-Annex I countries concerning emission reductions and their role in the flexible mechanisms and the amount of financial help for climate change adaptation, mitigation and sustainable development in developing countries.

6. Three Different Approaches to a Post-2012 Framework

As described above, the aim of this thesis is to assess the COP 15 negotiation agreements in the light of how climate change is addressed and if or to which extent financial mechanisms represent important elements of a post-2012 framework. Therefore it will be mainly focused on physical-scientific aspects of climate change and economic approaches to climate change. Opinions of climate scientists, economists and (environmental) NGOs about important elements of COP 15 negotiations' outcomes are analyzed in this chapter. It will be assumed that these groups play an important and influential role on climate change negotiations on political layer. Climate scientists define the scientific basis and contribute state-of-the-art knowledge about observed climate change, future climate change projections, climate change adaptation strategies and strategies to mitigate climate change (see chapter 3). NGOs act in behalf of the civil society and have the right to observe UNFCCC negotiations (see 2.4) as well as to contribute their opinions to the negotiating process. NGOs are often founded democratically to tackle specific topics and therefore an expertise will be assumed. Environmental economists have developed economic theories to approach to climate change and thereon based concrete mechanisms to mitigate climate change in a cost-effective way (see 3.3.3 and 4.1).
It is assumed that these groups cover a wide range of opinions concerning necessary climate policies and have a strong influence on decision-making on political level. Therefore these groups are chosen.

6.1 Climate-Scientific Approaches to a Post-2012 Framework

The National Academies of G8+5[20] counties in May 2009 claimed in a joint statement concerning COP 15 outcomes to agree on a long-term goal of 50% emission reduction by 2050 based on 1990-levels, increase research in low-carbon technologies, the development of strategies to accelerate the implementation of sustainable technologies for adaptation and mitigation through innovative economic incentives and regulatory instruments, the support of developing countries by providing sustainable low-carbon technologies and increased funding for the most vulnerable countries (G8+5 Academies 2009). "The Copenhagen Diagnosis: Updating the World on the Latest Climate Science" (The Copenhagen Diagnosis 2009) was published recently before COP 15 on November, 24th 2009 (Spiegel Online 2009) by leading climate scientists and contains latest findings of physical climate science. In this paper, the scientists refer to "*the most widely supported policy goal […] to limit global warming to at most 2°C above the preindustrial temperature level"* (The Copenhagen Diagnosis 2009: 52) but mention as well the claim of LDCs and AOSIS to limit global warming at most at 1.5°C (The Copenhagen Diagnosis 2009: 52). A temperature increase above 2°C would cause "*major societal and environmental disruptions through the rest of the century and beyond"* (The Copenhagen Diagnosis 2009: 52) but a temperature increase of 7°C by 2100 is possible according to the A1FI SRES scenario (The

[20] Academia Brasileira de Ciéncias, Brazil; Indian National Science Academy, India; Academy of Science of South Africa, South Africa; Royal Society of Canada, Canada; Accademia Nazionale dei Lincei, Italy; Royal Society, United Kingdom; Chinese Academy of Sciences, China, Science Council of Japan, Japan; National Academy of Sciences, United States of America; Académie des Sciences, France; Academia Mexicana de Ciencias, Mexico; Deutsche Akademie der Naturforscher, Leopoldina; Germany, Russian Academy of Sciences, Russia;

Copenhagen Diagnosis 2009: 51-52). Furthermore, the scientists state that a temperature increase of 1.5-2.0°C "*still carries a significant risk of adverse impacts on ecosystems and human society"* (The Copenhagen Diagnosis 2009: 52). Therefore the scientists assume "*if global warming is to be stopped, global CO_2 emissions must eventually decline to zero. The sooner the emissions stop, the lower the final warming will be"* and propose a cumulative CO_2 budget approach as a "*natural element of a climate policy agreement"*, in which the budget is distributed "*amongst countries […] on the basis of equity principles"* (The Copenhagen Diagnosis 2009: 52). To limit global warming at 2°C, a budget of 1000Gt CO_2 in the period of 2000-2050 is stated, but 350Gt CO_2 have been already emitted in 2000-2009 - vice versa with current emission rates this amount would be depleted by 2020 (The Copenhagen Diagnosis 2009: 52-53). Therefore emissions have to "*peak between 2015 and 2020 and […] to decline rapidly"*, a decarbonized global society with near-zero GHG emissions has to be archived by 2100 and emission have to be reduced by 80-95% by 2050 (in relation to 2000-levels) with a world average per capita emission of less than 1 ton CO_2 by 2050 (The Copenhagen Diagnosis 2009: 9).

This threshold is also considered as necessary by M. New, D. Livermann (both from University of Oxford) and K. Anderson (University of Manchester), all affiliated with the UK Tyndall Centre for Climate Change Research. They claim that policymakers should focus on implementing 2°C as a threshold value, although it "*remains a crucial political objective*" (Nature Reports Climate Change Vol. 3 2009: 144) because "*the challenges involved in reducing emissions soon and fast enough […] are much larger than people realize*" and to keep the temperature below this threshold an "*unprecedented collective will among the governments of both the developed and developing world*" (Nature Reports Climate Change Vol. 3 2009: 144) is needed. Therefore policies should include strategies to adapt to 4°C which requires "*fundamental socioeconomic and technological transformations […], assuming transformations are achievable through planning at all"* (Nature Reports Climate Change Vol. 3 2009: 144).

Although people and nature are able to adapt climate change to some extent, J. Rockström et al. (Stockholm University, Stockholm Environmental Institute) defined nine planetary boundaries (safe operating spaces for humanity with respect to the Earth's system) and describe the excess of three natural planetary boundaries (rate of biodiversity loss, climate change and human interference with the nitrogen cycle) (Nature Vol. 459 2009: 472-475). They propose a limitation of CO_2 concentrations of 350ppm and a radiative forcing of 1 Wm^{-2} above pre-industrial levels for a long-term stabilization of the climate system (Nature Vol. 459 2009: 473). This means a limitation of global warming below 2°C according to the IPCC AR4 (see 3.3.3).

Other leading climate scientists as J. Hansen (NASA Goddard Institute for Space Studies, New York) see the need to limit global warming significant below 2°C. Hansen et al. claim a scenario of global warming below 1.7°C and a CO_2 concentration of 350ppm (Open Atmospheric Journal, Vol. 2. 2008: 230). They state it is "*feasible to achieve a scenario that keeps additional global warming under 1°C*" (Atmospheric Chemistry and Physics Vol. 7 2007: 2306). Hansen argues that "*[i]t's crucial that we immediately recognize the need to reduce atmospheric carbon dioxide to at most 350 p.p.m. in order to*

avoid disasters for coming generations" (Nature Reports Climate Change Vol. 3 2009: 140)

Furthermore A. Binger (University of Georgia and science advisor to AOSIS) stated that "[*the target of] 2°C the majority of the world wants is absolutely crazy. 2°C is too much for too many people*" (Nature Vol. 462. 2009). He claims a target of 1.5°C or less, because *"[e]very person on this planet is better off at 1.5°C than they're at 2°C"* (Nature Vol. 462. 2009).

S. Kallbekken, N. Rive, G.P. Peters and J.S. Fuglestvedt (all from Centre for International Climate and Environmental Research Oslo) claim beside a global goal of a temperature increase limitation of 2°C a cumulative emission budget "*as an element in the design of climate policies*" (Nature Reports Climate Change Vol. 3, 2009a: 141). Furthermore, a short-term target for the next two decades in addition to a quantified long-term temperature target or cumulative emission target would "*provide much clearer guidance for mitigation*" (Nature Reports Climate Change Vol. 3, 2009a: 142).

M. Meinhausen (Potsdam Institute for Climate Impact Research) concretize the global carbon budgets and state that if 1000Gt CO_2 are emitted, the mean probability is 25% to exceed the threshold of 2°C, while emissions of 1440Gt CO_2 generate a mean probability of 50% to exceed 2°C and 890Gt CO_2 would create a mean probability of 20% according to the equilibrium climate sensibility (see 3.3.1) (Nature Vol. 458 2009: 1159).

Their colleagues L. Wilke, H. Schellnhuber and D. Klingenfeld (all Potsdam Institute for Climate Impact Research) refer to a study of the German Advisory Council on Global Change, which states a 67% probability not to exceed 2°C, if 750Gt are emitted by 2050 (WGBU 2009: 25-27) and present three emission reduction scenarios: If the global emissions would peak in 2011, the maximum emission reduction rate would be 3.7% including a left-over global emission budget of approx. 5Gt CO_2–eq in 2050; a peak in 2015 requires a maximum reduction rate of 5.3% per year and the emission budget would be dissaved by approx. 2047; a peak in 2020 would require a maximum reduction rate of 9.0% and the emission budget would be dissaved by approx. 2040 (PiK Report 116 2010: 12). Wilke et al. describe furthermore a "one human - one emission right"-principle, which is based on the above mentioned emission budget of 750Gt by 2050, 6.9 billion people in 2010, a reduction of global GHG emission of at least 50% by 2050 and an emission peak significantly before 2020. It allows 35Gt CO_2 or 5.1 tons CO_2 per capita and year by 2020, which are spread equally (PiK Report 116 2010: 11). Emission rights would be traded in a global so-called "peak and trade" system (which is organized by a world climate bank) for a certificate price of 5-15 US$ per certificate (equivalent to one ton of CO_2) to generate at least 100 billion US$ annually for developing countries by 2020 (PiK Report 116 2010: 11, 13-15, 17). A first commitment period would be in 2015-2020, subsequent commitment periods (including the time-frame, left-over emission budgets, allowed per capita and year emissions and taking the global population development into account) would be negotiated from 2015-onwards (PiK Report 116 2010: 11-12). Therefore climate scientists have defined clear scenarios for peak emissions and proposed strategies, how to stay below the global warming threshold of most 2°C. In addition, J. Slingo (Met Office UK) stated in an interview that "*we have to peak our emissions as soon as possible and start to decline […]; there is not much time […]; that's what the science is telling us now – more clearly I*

think than in previous times" (UK Foreign Office 2009).

S. Rahmstorf (Potsdam Institute for Climate Impact Research) considers COP 15 as the last chance to limit global warming below 2°C (Spektrum Vol. 12 2009: 88). Therefore he argues that a threshold value for global warming should be defined in a legally binding way, legally binding concrete emission reductions, which are in accordance with the carbon budget and legally binding short-term emission reduction targets by 2020 should define the outcome of COP 15 (Spektrum Vol. 12: 89). He claims a carbon price of 10-30€ per ton of CO_2 to provide 30-90 billion € annually for climate change adaptation and mitigation in developing countries (Spektrum Vol. 12: 89).

W. Sterk (Wuppertal Institute for Climate, Environment and Energy) claim an emission peak at latest by 2015, an emission reduction of 40% by 2020 (at least 30% should be achieved domestically) and at least of 80% by 2050 based on 1990-levels while aiming a limitation of global warming of at most 2°C and a world average CO_2-eq emissions of 1 ton per capita by 2050 (Sterk et al 2009: 6-7, 23).. Countries should develop commitment achievement plans (CAPs) and low-carbon development strategies (LCDS) to secure that the obligated targets can be achieved (Sterk et al 2009: 21-22). Industrialized countries should compensate 75-80% of the mitigation due to higher capacity and the historical responsibility on climate change (Sterk et al 2009: 7). A global public funding for research and development in adaptation and mitigation of at least 15 billion € by 2015 and at least 20 billion € by 2020 is needed. Furthermore, an insurance mechanism for adaptation in developing countries, a guaranteed public funding (for mitigation and technology transfer to developing countries) instead of emission trading and CDM (due to their low environmental integrity and effectiveness) represent an economic approach to climate change (Sterk et al: 7,27,30-33).

D.G. Victor (Stanford University, California) considers a global warming threshold of 2°C as "*a political delusion"*, because *"[n]obody knows what is safe"* (Nature Vol. 459, 2009: 909) due to several uncertainties concerning the impacts of this target. He furthermore stated that "*the effort needed to get to 2°C would be heroic […] and probably far beyond what real governments can achieve"* (Nature Vol. 459, 2009: 909). He describes the Clean Development Mechanism (CDM) which has "*mushroomed into a political liability […] as a disaster"* (Nature Vol. 461 2009: 343) because *"[m]any CDM credits do not represent real reductions in emissions"* (Nature Vol. 461 2009: 343). Therefore ambitions national policies are necessary as well as a funding for adaptation and technology transfer to developing countries or, due to the fact that carbon markets as the EU ETS or a possible bigger market in the USA are more likely, "*tougher rules for offsets while also promising full linkage to other markets that have comparably tough provisions*" (Nature Vol. 461 2009: 344).

R. Pachauri (Chair of the IPCC) stated in an interview on COP 15: "*I think the discussions have to be driven by science, that's why we're all here. If there were no scientific problems why would we be talking about taking any action, but it seems to me that in the discussions sometimes we're losing track of the science"* (Euronews 2009). He referred to the aspect that the proposed emission targets of developed countries on COP 15 are insufficient to limit global warming at most 2°C (see 3.3.3).

6.2 Non-Governmental Approaches to a Post-2012 Framework

Greenpeace International, one of the biggest global environmental NGO with approx. 2.74 million members worldwide in 2005 (Greenpeace 2007), presented the "Greenpeace Climate Vision" in May 2009. In this vision, Greenpeace claims a *"strong, equitable and global agreement coming out of the Copenhagen Climate Change Summit in December 2009*" (Greenpeace 2009: 9) in which industrialized countries should cut 40% of their emission by 2020 related to 1990-levels based on a legally binding treaty (Greenpeace 2009: 9). Global emissions should be reduced by at least 80% in 2050 based on 1990-levels (Greenpeace 2009: 11). In addition, industrialized countries should pay for emission rights to an "*adequate and predictable funding*" which generates at least 140 billion US$ annually for climate change mitigation and adaptation (including clean energy and forest protection) in developing countries (Greenpeace 2009: 9). Developing countries should reduce their emissions by 15-30% by 2020 related to the business as usual growth (Greenpeace 2009a: 3). Furthermore a funding mechanism to achieve zero emissions by 2020 from deforestation in developing countries, in particular Amazon, the Congo Basin, and the Paradise forests of Indonesia and Papua New Guinea, should be implemented in addition to the proposed emission cuts (Greenpeace 2009a: 3). The CDM should be only applied to the LDCs and developing countries with little capacities from 2013 onwards, due to "*the mechanism has allowed a net increase in emissions, compared to a situation where the CDM didn't exist*" (Greenpeace 2009a: 6). Current market-based solutions for mitigation are ineffective and should be replaced by new carbon market mechanism, which provide incentives for developing countries to invest in sustainable technology (excluding nuclear technologies and CSS) and contain "*long-term low-carbon development planning on a sectoral and economy-wide level*" (Greenpeace 2009a: 6).

Greenpeace International as well as more than 200 other national and international organizations NGOs as Avaaz.org, 350.org, Amnesty International, Oxfam International, Union of Concerned Scientists, Worldwide Wildlife Foundation (WWF) International e.g. (GCCA 2010) are members of the "TckTckTck"-campaign, which was founded by the Global Campaign for Climate Action (GCCA). More than 10 million people worldwide have joined the TckTckTck-call for climate action in advance of COP 15, whose opinions are in line with the above mentioned positions of Greenpeace international (GCCA 2010a). In addition, a fair, ambitious and binding agreement, which should represent the outcome of COP 15, should implement a long-term CO_2 stabilization level of less than 350ppm, include the target to peak the emissions no later than 2015 with a subsequent decline, protect marginalized people in rich and poor countries and establish sustainable conditions for people and the environment (GDCA 2010b).

The Inuit Circumpolar Council (ICC), an in 1977 founded indigenous peoples organization with 166,000 members, considers a more ambitious target. The ICC has published on November 13th, 2009 a "Inuit call for global leaders" and claimed a ratified post-2012 agreement including a CO_2-eq stabilization level of 350ppm to stay "*well below 2°C*" (ICC 2009: 1). G20 countries should create a climate change adaptation fund for adaptation and technology transfer to provide immediately 20 billion US$ and 100 billion US$ annually by 2020 (ICC 2009: 1). Furthermore a mechanism for adaptation assistance to support vulnerable groups and communities including financial provision, the devolvement of power to

the lowest possible level and adaptation assistance by Annex I countries (ICC 2009: 1). The ICC claims: "*we must do everything in our power to limit global temperature rise to well below 2°C*" (ICC 2009: 2).

Friends of the Earth International (FoE) shares the viewpoint as NGOs from the TckTckTck-campaign and the ICC, that Annex I countries shout account for the major share of the efforts for climate change adaptation and mitigation. The NGO claims as well a 40% emission reduction by industrialized countries by 2020 based on 1990-levels and 15-30% reduction related to business as usual scenarios for developing countries. Furthermore FoE International declines carbon offsetting (Joint Implementation or CDM) entirely (Foe 2009: 2-3). The organization argues that carbon offsetting delays needed economic transformation in developed countries, does not guarantee positive sustainable development and financial transfer to developing countries (FoE 2009: 3). FoE International claims a new financial mechanism instead of the Climate Investment Fund (CIF) (which is a proposal by the World Bank) that allocates financial resources on the needs-based principle with a financial volume of 200 billion US$ annually for climate change adaptation and mitigation in developing countries (FoE 2009: 4). Furthermore forests should be taken out of offsetting mechanisms, which means that reducing emissions from deforestation and forest degradation (REDD) should not be credited – instead FoE International claims a new mechanism to protect Earth's forests (FoE 2009: 5).

A complete abolishment of market-based approaches to adapt to and to mitigate climate change represents the opinion of a people's declaration which has been composed during Klimaforum09, an open grass-roots summit in Copenhagen with more than 50,000 participants parallel to the COP 15 negotiations. This declaration is titled with "System change – not climate change: A Peoples Declaration from Klimaforum09" (Klimaforum09 2009: 1; Klimaforum09 2009a: 12). In this paper, which is signed by 295 organizations and which was handed out to COP delegates on December 18th, 2009, people claim for "*complete abandoning of fossil fuels within the next 30 years*", agreed 5-year milestones to achieve this target and a 40% emission reduction by 2020 related to 1990-levels (Klimaforum09 2009: 5). Furthermore the costs that have to be paid to compensate climate change impacts have to be recognized and accepted including the provision of "*new, mandatory, adequate, and reliable financing and patent-free technologies*" (Klimaforum09 2009: 10) for adaptation and mitigation in developing countries. Market-based solutions present "*false and dangerous solutions*" (Klimaforum09 2009: 10) because they treat a common planetary resource – the atmosphere – as a commodity that can be owned and traded. Therefore an equitable tax (which is returned equitable to people) is preferable and should partly compensate adaptation and mitigation, a funding (free of market mechanisms and financial institutions including direct regulations for a fossil fuel phase-out) and the implementation of renewable energy should represent key elements of a global solution (Klimaforum09 2009: 10-11).

In contrast to this point of view, the non-profit think tank members C. Gerstetter and D. Marcellino (Ecologic Institute Washington D.C.) claim that market- based mechanisms as the CDM (the strongest mechanism for technology transfer) should be continued but complemented by other measures. Due to

the fact that only certain developing countries benefit from this mechanism, additional mechanisms as public funds for technology research, private investments and development (Gerstetter et al.2009: 3, 15) should be implemented to "*address underfunded stages of the technology cycle and cover all countries*" (Gerstetter et al.2009: 3). They furthermore argue that a new technology body under the UNFCCC to synergize technological expertise is necessary with an "*equal weight in decision making*" between developed and developing countries (Gerstetter et al.2009: 16).

This point of view is not shared by L. Lohmann (The Corner House UK, Durban Group for Climate Justice), author of "Carbon Trading"[21] who argues that "*carbon markets cannot be a part of intelligent climate policy*" (Development and Change Vol. 40(6) 2009: 1076). He defined several arguments why financial mechanism as carbon trading (IET) or carbon offsetting (CDM e.g.) do not meet the objective and therefore should not be applied. Carbon trading would just decelerate the necessary shifts from fossil-fuel use and supports fossil-intensive industries to continue with business-as-usual (Development and Change Vol. 40(6) 2009: 1066, 1075-1076). He furthermore argues that the emission reductions or savings of the baseline scenarios, to which real projects are related, do not represent a measureable equivalent; therefore the purpose of CDM projects e.g. are approached ineffectively (Development and Change Vol. 40(6) 2009: 1066, 1074). Positive activities to mitigate climate change in both developing and developed countries (through renewable energy e.g.) and to promote technology transfer to developing countries are undermined by a delay of a fossil-fuel phase-out (Development and Change Vol. 40(6) 2009: 1066, 1074). Lohmann claims pathways for long-term shifts towards sustainability. This includes changes in practices and institutions which provide fossil fuels, building up knowledge to manage systematic risks in long-term and social shifts for a "*democratization of financial decision-making structures […] for broad-based, democratic, post-fossil, long-range social planning based on co-operative inquiry*" (Development and Change Vol. 40(6) 2009: 1075- 1079). Therefore he considers carbon markets and their purpose as an indicator for addressing climate change mitigation in a wrong way while substantial shifts towards a low-carbon society are necessary.

6.3 An Economic Approach to a Post-2012 Framework

The most comprehensive economic analysis of the consequences of global warming is published by N. Stern in October 2006, which is also known as the Stern Report. Therefore the subsequent described economic approach refers to the in 2006 published Stern Report and his in 2009 published book "The Global Deal"[22]. Stern described COP 15 in advance "*as the most important international gathering since the Second World War*" (Stern 2009a: 18). One central statement in his economic analysis is:"*strong, early action on climate change outweigh the costs*" (Stern 2006: i).

[21]Larry Lohmann: "*Carbon Trading - A Critical Conversation on Climate Change, Privatization and Power"* (2006) published by Dag Hammarskjold Foundation, Durban Group for Climate Justice and The Corner House has been downloaded more than 350.000 times (Fora.tv 2010).

[22] Nicholas Stern: *The Global Deal – Climate Change and the Creation of a New Era of Progress and Prosperity" (*2009) published by Bodley Head, UK and Public Affairs, USA

To mitigate dangerous climate change he claims a CO_2-eq stabilization level of 450-500ppm, which is equivalent to a global mean temperature of 2~2.5°C (see 3.3.3) (Stern 2008: 8). Therefore a global emission reduction of at least 50% related to 1990-levels by 2050 is required and he proposes industrialized countries to commit emissions cuts by 20-40% related to 1990-levels by 2020 and 80-90% related to 1990-levels by 2050 (Stern 2008: 9-10; Stern 2009: 146). He claims that developed countries should take the lead in climate change mitigation and obligate themselves to reduce emissions significantly. Developing countries should prepare on national level to adopt binding emission targets in 2020 (and achieve 2 ton per capita and year CO_2-eq emissions by 2050), but only if developed countries have committed themselves and provided financial and technological transfer. Vastly emerging nations should adopt national emission targets earlier than 2020. Emissions should peak before 2023 and the world should achieve 10Gt GHG emissions per year or per capita and year emissions of one ton CO_2-eq by 2050 (Stern 2008: 8, 11). Stern furthermore claims an international cap and trade system (which should apply the three principles effectiveness, efficiency and equity). This system should manage the risks of climate change by defining an absolute emission limit (cap), mitigate climate change in a cost-efficient way, and create and enforce transfers of financial recourses as well as technologies to developing countries for a sustainable (low-carbon) development (Stern 2008: 19-22). Stern evaluates the CDM as "*not able to generate or absorb the financial and technological flows needed under a global deal*" (Stern 2008: 15), therefore the structure of the CDM should be changed and renewed from a project-based mechanism to a wholesale mechanism with sector-specific targets or technology benchmarks (Stern 2008: 16). Stern furthermore proposes a funding for development in developing countries beside the existing financial mechanisms (Stern 2009: 146-147). About 15 billion US$ per year are needed for a program to halve deforestation, 5 billion US$ per year are needed for research and development of low-carbon technologies and more than 75 billion US$ by 2015 for climate change adaptation and mitigation in developing countries (Stern 2009: 147).

An overall global policy framework should be designed to guarantee effectiveness in addressing climate change and efficiency concerning adaptation and mitigation costs. Well designed action, although implemented with different speeds in different countries would harm economic growth and competitiveness, while inactivity "*will undermine growth*" (Stern 2008: 41-42) and generate costs. He defined three stages for the implementation of a post-2012 framework under the UNFCCC. At first, on COP 15 international targets, developed countries caps and the degree of responsibility of developing countries should be defined in a centralized way. Second, in 2010-2020 effective and cooperative institutions should govern finance and technology decentrally with their expertise and developing country caps should be defined under these institutions. Stern proposes the International Energy Agency (IEA) for energy-related and the World Trade Organization (WTO) for carbon market-related issues. Third, from 2020-onwards an international emission trading system (cap and trade) which integrates all countries and has to be implemented and technological agreements have to be followed. He claims that developing countries who will account for 8 of estimated 9 billion global citizens in 2050 should "play a strong role in shaping agreements" (Stern 2008: 41-45).

Table 7 summarizes opinions of the three above discussed approaches to a post-2012 framework.

Table 7: Climate-Scientific, Non-Governmental and Economic Approaches

Criteria	Climate-Scientific Approach	Non-Governmental Approach	Economic Approach
Legal Status	Binding	Binding (strong, equitable, global)	Binding (effective and efficient)
Global Mean Temperature Threshold	1.5 or less – 2.0°C	well below 2°C - 2°C	2~2.5°C
Emission Peak	at latest in 2015; in 2015-2020	at latest 2015	before 2023
Emission Reductions Global by 2020 (Related to 1990-Levels)	40%	40%	-
Emission Reductions Global by 2050 (Related to 1990-Levels)	50%; 80-95%	at least 80%; 100%	at least 50%
Emission Reductions Annex I Countries by 2020	carbon budget approach: 750Gt CO_2 in 2000-2050; 75-80% of all mitigation	40%	20-40%
Emission Reductions Annex I Countries by 2050		-	80-90%
Developing Countries	-	15-30% related to business as usual growth	should be defined in 2010-2020
Per capita and year Emissions by 2050	1 ton	-	1 ton
CO_2 Stabilization Level	350ppm	350ppm	-
CO_2-eq Stabilization Level	-	350ppm	450-500ppm
Emission Cap and Trade	Peak and Trade System based on a carbon budget and a “one human – one emission right” distribution; Strategies for CAPs	Decline of Carbon Trading; Carbon Trading decelerates fossil-fuel phase-out	International Carbon Trading System with all countries included from 2020-onwards
CDM	Funding instead of CDM – low environmental integrity and effectiveness	CDM only applied to LDCs; Decline of CDM: CDM should be complemented by other measures; CDM delays necessary social shifts to low carbon economies	CDM should be continued – shift from project based to wholesale mechanism necessary, governed by IEA and WTO
Funding	Global public funding for adaptation and mitigation; R&D funding of at least 15 billion US$ by 2015 and 20 US$ by 2020;	20 billion US$ immediately; 100 billion US$ by 2020;140-200 billion US$ annually for adaptation and mitigation	at least 95 billion US$ by 2015 annually for R&D, deforestation and development

7. Conference of Parties 15

7.1 Pre-Copenhagen Negotiations

The official pre-Copenhagen negotiations under the two track- approach (see chapter 5) started in Bonn as the fifth session of the AWG-LCA and the seventh session of the AWG-KP from March 28th until April 8th, 2009. The Chair of the AWG-LCA was mandated to present a negotiation text at the next session, on which the negotiations would be based (Gutiérrez et al. 2009: 2). It was agreed to implement a shared vision for long-term co-operative action under the Convention according to the building blocks of the Bali Road Map. Therefore Parties started work in four contact groups under the AWG-LCA for mitigation, adaptation, finance and technology (Gutiérrez et al. 2009: 2). The AWG-KP dealt about greenhouse gas reductions of Annex I countries, flexible mechanism, LULUCF issues and legal matters (Gutiérrez et al. 2009: 13). The AWG-LCA and AWG-KP sessions were affected by discussions about the global mean temperature threshold, the historical responsibility of Annex I countries, emission reductions of Annex I countries and contributions of non-Annex I countries. The organization of the forthcoming negotiation phase represented the key discussion element in both tracks (Gutiérrez et al. 2009: 12-13). Eight months were left until the beginning of COP 15.

The Bonn Climate Talks in June 1st-12th, 2009 represented the sixth session of the AWG-LCA and the eighth session of the AWG-KP. A negotiation text was introduced by the AWG-LCA chair, which consisted of almost 200 pages and was discussed during the session. Parties were able to make proposals and the main outcome of the session was a 200-page draft negotiations text including all building blocks of the Bali Road Map, namely a shared vision for long-term co-operative action, mitigation, adaptation, finance, technology and capacity building (Appleton et al. 2009: 1). The AWG-KP discussed Annex I emission reductions, but developing countries pointed out, that the proposed commitments are not ambitious enough to meet the targets required by science (Appleton et al. 2009: 10-11). Six months were left until the beginning of COP 15.

The next sessions of the AWG-LCA and AWG-KP were held in Bonn from August 10th-14th, 2009. AWG-LCA negotiations were mainly about elements of the draft text, which should be supplemented by different consolidating and facilitating tools for the next session (Appleton et al. 2009a: 1). The AWG-KP continued its discussions about Annex I emission reductions and mechanisms for a post-Kyoto period (Appleton et al. 2009a: 7-8). Although the major objective was an agreement in Copenhagen, no real progress has been made due to significant different positions concerning elements of this agreement (Appleton et al. 2009a: 16). 114 days were left until the beginning of COP 15.

The Bangkok Climate Talks between September 28th- October 9th, 2009 - the seventh session of the AWG-LCA and the ninth session of the AWG-KP – made little progress concerning certain topics in the agenda (Appleton et al. 2009b: 1). Technical details and specific rules of flexible mechanisms were clarified in AWG-KP negotiations, but the emission reductions of Annex I countries remained a central discussion topic (Appleton et al. 2009b: 19) The AWG-LCA made progress in clarifying issues of

adaptation, technology and capacity building, but, as in the AWG-KP, mitigation and financing represented discussion topics, to which Parties had diverging opinions (Appleton et al. 2009c: 5, 9). Furthermore developing countries claimed to merge the two tracks, while developed Parties preferred a continuation of working in two AWGs (Appleton et al. 2009b: 20). The delegates seemed to realize that critical issues could only be solved in bilateral or high-level negotiations on COP 15 and a "*general understanding […] that the outcome in Copenhagen may not deliver a neatly packaged final product*" (Appleton et al. 2009c: 20) developed. Two and a half months were left until the beginning of COP 15.
The last meetings before COP 15, held in Barcelona on November 2nd-6th, began with a suspension of negotiating under AWG-KP contact groups by the African Group and some developing countries, who stated that *"they would not accept scheduling of other contact group meetings under the AWG-KP until the group on Annex I mission reductions completes its work"* (Appleton et al. 2009b: 20). Claims for a scaling-up of Annex I emission reductions became louder and little progress was made concerning flexible mechanisms, but the breakthrough failed to appear (Appleton et al. 2009c: 15). The AWG-LCA made small progress in clarifying options or choices, which could be put on the table in Copenhagen, but concluding many different positions concerning contents of the BAP building blocks remained (Appleton et al. 2009c: 15). Although the major objective was still to finalize COP 15 with an agreement, it seemed to become more likely, that Copenhagen would at best end with a number of COP decisions but not with a comprehensive agreement (Appleton 2009b: 16). The negotiation text, which was prepared during the fifth and sixth session of the AWG-LCA, was still almost 200 pages long after Barcelona and many brackets in the text were not removed yet (Appleton et al. 2009b: 2; Appleton 2009c: 16-17). While European Commission president M. Barroso stated in September 2009 '*If we do not sort this out, it risks becoming the longest suicide note in history"* (Shanahan 2009: 4), UN Secretary-General Ban Ki-Moon said that he no longer expects a legally-binding outcome in Copenhagen (Appleton 2009c: 16).

7.2 COP 15 in Copenhagen

The Conference of Parties 15 took place from December 7th-19th, 2009 in Copenhagen, Denmark. This conference was one of the biggest environmental conferences in history and one of the biggest meeting of Heads of State and Government outside the UN General Assembly in New York (Appleton et al. 2009d: 27). More than 10,500 delegates, 13,500 observers and 3,000 media representatives joined COP 15, while in total more than 40,000 people applied for acquisition at COP 15 (UNFCCC 2010m; Appleton 2009 et al.: 27). Many NGO and media representatives had to wait for hours outside in the cold during the second week of the conference without finally getting a registration, due to the limited capacity of about 15.000 people of the Bella Centre, in which COP 15 was hosted. 120 Heads of State and Government attended the negotiations during the high-level segment in December 16th-18th (Appleton 2009d: 28) – therefore this conference was unique in history, because climate change negotiations were raised on the highest possible political level. During the Opening Ceremony, Connie Hedegaard was elected as the COP President and encouraged the delegates to "*mark this meeting in*

history [and] get it done […] because if we miss this chance, it may take years to get the next one" (Appleton et al. 2009d: 3). In this ceremony, delegates of many countries emphasized the need for action, the integration of developed and developing countries in a future framework, the importance of the Convention's principles and claimed different limits for the global mean temperature increase (1.5°C or 2°C), which should be integrated in a legally-binding outcome (Appleton 2009d: 3).

More than 220 exhibitions and 200 side events took place during COP 15 (UNFCCC 2010m). Researchers, NGOs, business co-operations, indigenous peoples organizations, economists, youth organizations, delegates, politicians and negotiation groups presented results of work, opinions and different approaches to specific aspects of climate change. During roundtable discussions people could comment or ask questions to experts. The speech of Nobel laureate Al Gore represented a highlight of the side events. Gore talked about the latest findings in oceanographics and presented conclusions about the consequences of sea level rise due to melting Greenland and Antarctic ice (COP 15 2009). He pointed out, that each meter of sea level rise will cause 100 million additional climate refugees (COP 15 2009). During the two weeks of COP 15, hundred thousands of people from all over the world demonstrated for climate justice and ambitions climate deal. On the Climate Action Day on December 12th, 2009, more than 50.000 people joined a demonstration march from the city centre of Copenhagen to Bella Centre (Spiegel Online 2009c). The Klimaforum09, the people's summit, counted about 50.000 visitors in their premises (Klimaforum09 2009a: 12) while many people attended to events, concerts, lectures and roundtable discussions in Fristaden Christiania (the alternative commune in Copenhagen) and Hopenhagen City, a forum with concerts and exhibitions on the town hall square in Copenhagen.

AWG-LCA and AWG-KP Negotiations

The AWG-LCA continued its work on COP 15 and formed several informal drafting groups. Each group should address one certain building block of the BAP and had the purpose to produce texts, which could be formed into COP decisions. Therefore the procedure was changed from integrated negotiations to negotiate and produce components, which should be combined later. The drafting group on a shared vision discussed mainly about, whether to focus this vision on limiting global warming below 2°C, as many countries claimed, or at 1.5°C, as AOSIS claimed (Appleton et al. 2009d: 16). Different positions remained concerning, if or to which extend developing countries should be integrated in concrete emission reductions (Appleton et al. 2009d: 16-17). Parties discussed the implementation of different adaptation mechanisms for loss and damage, vulnerability or response measures e.g. and the degree of support in adaptation for vulnerable countries by developed countries (Appleton 2009d: 16-17). The design of financial mechanisms was intensively discussed in the finance drafting group. Many Parties considered the World Bank as a trustee partner, while especially developing countries preferred a new organization to govern funding (Appleton et al. 2009d: 18). Many different positions remained in the drafting group for technology. Some Parties preferred a link between financial mechanisms with the technology mechanism – others didn't. The governance structure of the technology mechanism was negotiated intensively as well as the activities, which should guarantee technological support for

developing counties (Appleton et al. 2009: 18). The drafting group for capacity building discussed the linkage between the capacity building mechanism and financial mechanisms, performance indicators, standards and the institution, which should govern the capacity building mechanism (Appleton et al. 2009d: 18). The AWG-LCA closing plenary on December 16th, 2009 adopted a lot of decisions as "unfinished business" due to the procedure that "nothing is agreed until everything is agreed" (Appleton et al. 2009d: 18). After two years of AWG-LCA negotiations, none of the building blocks, which have been established under the BAP, has been finalized for a COP adaptation. Two days remained until the official end of COP 15.

The AWG-KP continued its work during COP 15, too, and established four contact groups to for further negotiations. The contact groups were divided into Annex I emission reductions, political consequences, legal matters and other issues (Appleton et al. 2009d: 19). 60% of the time was planned for the work on Annex I emission reductions due to an agreement of the Barcelona Climate Talks in November 2009, which was based on many uncertainties and diverging opinions in key questions (Appleton et al. 2009d: 19). The Parties discussed about length and number of commitment periods, reference years for emission, the inclusion of non-Annex I countries in further commitment periods, the use of flexible mechanisms and LULUCF, measurement and verification of emission reductions, and the degree of Annex I reductions in domestic sectors (Appleton et al. 2009d: 19). The outcome was a report with different decision options, which could be put on the table for consideration for the COP. Parties agreed on the implementation of flexible mechanisms, but were unable to find consensus in technical questions concerning the structure of flexible mechanisms (Appleton et al. 2009d: 21). It was furthermore agreed that LULUCF projects can be implemented in the CDM. Therefore CDM credits could be generated by aforestation projects (Appleton et al. 2009d: 21). Drafted decisions represented the outcome of negotiations on methodological issues of emission reductions, including a draft decision about the implementation of a Compliance Committee, which should organize and monitor further commitment periods with its mechanisms (Appleton et al. 2009d: 21-22). The final outcome, a report with draft decisions for the COP was adopted in the closing plenary, but many uncertainties of key issues remained for clarification on COP level (Appleton et al 2009d: 21-22). Both AWGs finished its work on December 16th, 2009 and presented negotiated results as draft decisions to the COP. Many key questions about the structure and design of the BAP building blocks, Annex I emission reductions, the inclusion of non-Annex I countries in further commitment periods, additional financial and technology mechanism remained unsolved two days before the official end of COP 15.

The "Danish Text"

During the first week of COP 15 "The Danish Text" leaked to the public - a secret proposed agreement which was drafted by representatives of Denmark, the USA and the UK and has been shown to a limited group of selected countries. Especially developing countries considered this document as extremely undemocratic and L. Stanislaus Di-Apeng (Chairman of G77 and China) described the text as a "*very dangerous document for developing countries. It is a fundamental reworking of the UN*

balance of obligations. It is to be superimposed without discussion on the talks "(Guardian 2009a). Furthermore developing countries criticized the Danish COP Presidency for shifting away from UN-negotiation principles towards undemocratic and less transparent negotiations and claimed, that the work should be continued in the AWG-LCA and AWG-KP (Appleton 2009d: 28). In spite of critics on this proposal, many delegates considered the official negotiation text as too complicated for the high level negotiations. "*The text […] is full of brackets – Ministers and Heads of State cannot negotiate based on them*. "(Appleton et al. 2009d: 28). Different procedures how to continue the negotiations were discussed due to the remaining time of a few days until the high-level negotiation started and due to the small chance to make an agreement based on the complex official negotiation text (Appleton et al. 2009: 28). Therefore countries suspended the negotiation for one day to consult in informal negotiation groups, in particular in a "friends of the Chair" group, which was established by the COP President to conduct further negotiations. Although many left-out countries claimed missing transparency, the group made steps forward to an agreement (Appleton et al. 2009d: 28).

NGOs

At the beginning of the second week, NGOs claimed more transparency, because many NGO-representatives were left-out from the negotiations due to security reasons. The number of NGO-members was reduced from day to day and finally a very limited amount of NGO-members was allowed to participate in the high-level segment. A NGO-member claimed his rights as a NGO-observer and argued *"How can we keep the pressure when we do not know what is going on and are not even allowed near the building where these crucial negotiations are taking place."* (Appleton et al. 2009d: 28). Many delegates, UN officials and observers described the negotiation status during the second week as "deadlocked" (Ecopolity 2009) and did not see a successful outcome, if a complete draft text for Ministers to review is not on the table.

High Level Negotiations

With only two days left, the high-level segment of the COP 15 negotiations started officially on December 16th, but many Ministers and Heads of State and Government arrived one or two days earlier. In total, 115 Heads of State joined the negotiations and changed the atmosphere of the conference (UNFCCC 2010m; Appleton et al. 2009d: 28). The procedure of negotiations in contact groups under the AWGs was changed into negotiations in informal small groups on highest political levels (Appleton et al. 2009: 28). These informal meetings were behind closed doors while Heads of State hold national statements during the official high-level meeting in the plenary hall. Furthermore C. Hedegaard gave the COP Presidency to the Danish Prime Minister L. Rasmussen. She considered it as an appropriate measure, that a Head of State presides the attendance of many Heads of States (Guardian 2009f). Negotiations in the "friends of the Chair group" represented the most significant step forward based on an initiative of COP President L. Rasmussen, which included representatives of the USA, UK, Brazil, India, G77 and China, Russia, Mexico, AOSIS, UN General Secretary Ban Ki-Moon

and representatives of other developed and developing countries (Appleton 2009d: 8). The “friends of the Chair” group negotiations among 25 countries lasted until Friday, December 18th – the official end of the negotiations. At the same time, many Heads of State met in bi- and multilateral meetings to discuss strategies for further negotiations. The “friends of the Chair” negotiations set up a new document, which was later called the “Copenhagen Accord”. Key issues, which have been mainly agreed in the AWGs were included in this draft while other elements, as Annex I emission reductions e.g., were still under discussion and marked with “X and Y” (Spiegel 2010: 129). A leaked recording of informal negotiations during the afternoon of December 18th between U.S. President Obama, the German chancellor Merkel, the French President Sarkozy, UK Prime Minister Brown, Indian Prime Minister Singh and He Yafei, who represented the Chinese Prime Minister Wen, contains intensive discussion about the inclusion of India and China as vastly emerging countries in a future agreement. These discussions were based on this paper, which was produced during the “friends of the Chair” negotiations. Different opinions, especially about emission reductions of Annex I countries and about possible actions of developing countries, were still on the table. In this leaked recording, which was published by “Der Spiegel” in May 2010, Heads of State of developed countries tried to convince the Chinese representative and Indian’s Prime Minister Singh to halve their emissions by 2050 while proposing 80% emission reductions for industrialized countries. But the representatives of China and India considered this offer as unacceptable (Spiegel 2010: 128). Sarkozy argued that “*The west has pledged to reduce greenhouse gas emissions by 80%. And in return, China, which will soon be the biggest economic power in the world, says to the world, commitments apply to you, but not to us*. *This is utterly unacceptable ... This is about the essentials, and one has to react to this hypocrisy*" (Guardian 2010). The Chinese representative answered “*We have said very clearly that we must not accept the 50 per cent reductions. We cannot accept it. I heard President Sarkozy talk about hypocrisy. I think I'm trying to avoid such words myself. I am trying to go into the arguments and debate about historical responsibility*" (Guardian 2010). Merkel claimed emission cuts of developing countries and to finish with an agreement. She furthermore argued that the world would exceed the 2°C-limit, even if all industrialized countries would stop their emissions immediately (Spiegel 2010), but the Indian Prime Minister Singh blamed her for *“pre-judging options”* (Guardian 2010). The discussions in this informal meeting continued without agreement until L. Rasmussen, who was chairing this meeting, offered a 40-minute break for consultation (Spiegel 2010: 131). This meeting was not continued, but subsequent the Indian Prime Minister Singh, the Chinese Prime Minister Wen, the Brazilian Prime Minister da Silva and the President of South Africa Zuma held consultations in a private meeting room (Spiegel 2010: 131). Obama, who suddenly entered the room, joined these consultations and continued negotiating without European representatives (Spiegel 2010: 131). These Heads of State removed all uncertainties from the text by deleting fragments such as concrete quantified emission reductions e.g. (which were considered as necessary and important from the European perspective) (Spiegel 2010: 131). The draft paper at this stage has contained elements which were agreed by some industrialized and developed countries while other debatable elements were removed completely. This version of the “Copenhagen

Accord" therefore represented a minimal consensus. These multilateral negotiations happened on late afternoon and early evening on Friday December, 18th during the last official hours of COP 15. At the same time many rumours about the outcome of these secret and closed negotiations made the round in Bella Centre. Especially representatives of countries, who have been left-out of these negotiations, waited in the corridors and plenary halls for results. Different versions of the "Copenhagen Accord" were spread in the media and in the internet and intensive discussions in the COP closing plenary seemed to be in the offing (Spiegel Online 2009a).

Closing Plenary

The closing plenary of COP 15 started at 3:00 a.m. on December, 19th – hours after the official ending of COP 15. This plenary session, which has been often called "The Chaos-Night of Copenhagen" afterwards (Spiegel Online 2009b), was opened by COP President Rasmussen, who asked the COP to adapt the proposal after a offered consultation time of one hour (Appleton et al. 2009d: 7). The proposal on the table was the "Copenhagen Accord", which has been modified and agreed in the negotiation round of Obama, da Silva, Singh, Zuma and Wen. Many countries expressed their concerns about the less transparent and undemocratic process, which has produced this proposal. Tuvalu pointed out, that the "Copenhagen Accord" lacks of scientific basis and does not include a continuation of the Kyoto Protocol. Furthermore it would "*betray our people and sell our future. Our future is not for sale*" (Appleton et al 2009: 7-8) and cannot be accepted. Venezuela, Bolivia, Chile and Cuba did not support the "Copenhagen Accord" as well, due to lack of transparency in the negotiations (lack of respect for sovereign nations) and the fact that 60 minutes are given to the countries to decide about "*lives of millions of people"* (Appleton 2009d: 8). Sudan (for G77 and China) condemned the document, because it threatens millions of lives and livelihoods in developing countries, and described the offer of 100 billion US$ as "*a bribe*" (Appleton et al. 2009: 8). Other countries, as the Maldives, Senegal, Algeria, Ethiopia (for the African Union) and Grenada (for AOSIS) supported the Accord and described the negotiations as multilateral and considered the Accord as a starting point for further discussions towards a legally-binding agreement - although they acknowledged a lack of missing the 1.5°C target and concrete emission reductions (Appleton et al. 2009d: 8). Many developed countries as the EU, Russia, Japan and many developing countries as India, China, Brazil and Lesotho (for the LDCs) supported the Accord as a compromise, although many countries considered missing justice and important elements in this document (Appleton et al 2009d: 8). E. Milband, UK's climate secretary, urged the COP to adopt the Accord to provide fast-start financing and to act in a responsible way for mitigation instead of "*wrecking the conference*" (Appleton et al. 2009: 8). After five hours of intensive discussions about the adaptation of the Accord, COP President Rasmussen suspended the session at 8:03 in the morning of December, 19th. His vain efforts of to push the delegates forward to adapt the Accord were criticized by many delegates, who emphasized the procedures of the UNFCCC and the COP President's role as a neutral moderator (Guardian 2009c). Informal floor negotiations during the subsequent approx. two and a half hours came to the conclusion, that no consensus, which was

needed for the adaptation of the Accord, can be reached due to the resistance of some countries. Therefore at 10:35 a.m., COP Vice President P. Weech (Bahamas) proposed to adopt a decision which "*takes note of the Copenhagen Accord*" (Appleton et al. 2009d: 9). The legal status of the "Copenhagen Accord" as a note is non-binding, but it represents a document, which can be considered as a basis for further negotiations towards a legally-binding outcome. Therefore the COP adopted this decision in consensus that no consensus concerning the "Copenhagen Accord" can be reached.

7.3 The Copenhagen Accord

As described above, the COP "took note" of the Copenhagen Accord with decision 2/CP.15 of December 19th, 2009, after long and intensive discussions during the closing plenary of COP 15. The Accord, which has been proposed by the COP President and modified during high-level negotiations on December 16th-18th, 2009, represents the most notable outcome of COP 15. The Copenhagen Accord is structured and designed as an agreement, but due to the fact that no consensus for this Accord has been reached during the closing plenary, the Copenhagen Accord in its current form has no legal or obligating character - therefore all countries' actions and measures are voluntary. The Copenhagen Accord is divided into twelve sections and begins with an emphasis of the Convention's principles and objectives by Heads of State and Government and their delegations and Ministers.

The first section highlights the strong political will to *"urgently combat climate change […] - one of the greatest challenges of our time"* (UNFCCC 2009c: 1). Therefore a long-term co-operation is needed to limit global warming below 2°C. The Accord refers to scientific findings about climate change impacts, which are recognized as "*dangerous anthropogenic interference with the climate system"* (UNFCCC 2009c: 1). Comprehensive action for sustainable development is needed based on equity according to the common but differentiated responsibilities of the Convention (see 2.2.2; UNFCCC 2009c: 1). The need of mitigation actions represents the context of the second section. The Accord refers to the IPCC AR4 and defines that *"deep cuts in emissions are required"* (UNFCCC 2009c: 2) to keep the temperature increase below 2°C and that peak emissions should be achieved as soon as possible. The Accord underlines that developing countries should have the right to peak their emissions later than developed countries and to focus on economic and social development. A low-carbon strategy furthermore is needed to achieve sustainable development and to stay below the defined global warming threshold value (UNFCCC 2009c: 2). The third section describes the co-operative provision of financial and technological support and capacity-building for adaptation in developing countries and countries that are vulnerable for climate change adverse impacts. In this section, the LDCs, AOSIS and African countries are identified as countries that are the most vulnerable and have the highest need for climate change adaptation (UNFCCC 2009c: 2). Subsequent Annex I countries are obligated to submit their quantified individual or joint emission reduction targets by 2020 due to the fact that section two does not contain a quantified global target (or cap). Furthermore developed and developing countries are obligated to measure, verify and report their emissions. Non-Annex I countries should submit plans of their actions by 2020, which should take the Convention's objective and its principles (see 2.2.1 and

2.2.2) into account (UNFCCC 2009c: 2). The implementation of measurement, verification and reposting of emissions should be based on National Communications according to guidelines of the COP (UNFCCC 2009c: 2).The deadline to submit Annex I and non-Annex I countries' commitments and plans to the UNFCCC Secretary is defined as January, 31st, 2010. LDCs and AOSIS countries are encouraged to undertake actions voluntarily based on support. Section six describes the immediate implementation of a mechanism to reduce emissions from deforestation and forest degradation (REDD-plus). The necessary financial resources should be based on financial support from developed countries (UNFCCC 2009c: 2). Furthermore, different cost-efficient and market-based approaches to address climate change are defined as opportunities to mitigate climate change. The eighth section defines measures for funding. In 2010-2012 developed countries provide 30 billion US$ for adaptation, mitigation and capacity building in developing countries. Furthermore developed countries should commit to provide up to 100 billion US$ annually by 2020 based on public, private, bi- and multilateral sources (UNFCCC 2009c: 3). The Copenhagen Green Climate Fund is established to govern most of the provided financial resources (UNFCCC 2009c: 3) and should be managed by a high-level Panel, which is established under section nine. This high-level Panel should study the contributions of developed countries to provide the necessary financial support (UNFCCC 2009c: 3). The Copenhagen Green Climate Fund should come into effect as "*an operating entity of the financial mechanism of the Convention"* (UNFCCC 2009c: 3) to provide support in projects, policies and development in different fields of addressing climate change as REDD-plus, technology development or capacity-building (UNFCCC 2009c: 3). A Technology Mechanism is furthermore established in section eleven to *"accelerate technology development and transfer in support of action on adaptation and mitigation"* (UNFCCC 2009c: 3). National inventions of developing countries to implement sustainable development technologies should gain technological support from this mechanism (UNFCCC 2009c: 3). Section 12 defines an implementation period of five years, therefore all actions (emission commitments, funding and mechanism) which are established under the Copenhagen Accord should be implemented completely until 2015 (UNFCCC 2009c: 3). In addition, the implementation of the Accord should be assessed to reflect, if measures defined in the Accord are adequate. The Accord outlines the long-term co-operative action including the global warming threshold value of 1.5°C, which should be reconsidered and assessed as a possible target for long-term climate stabilization (UNFCCC 2009c: 3) due to continuous development processes of climate science. The Copenhagen Accord contains subsequent two appendices. Appendix I is a table, to which Annex I countries (who support the "Copenhagen Accord") should submit their individual or joint quantified economy-wide emission reduction targets by 2020 including a base year. Non-Annex I countries should submit their national appropriate mitigation actions to Appendix II.

Annex I and non-Annex I countries have submitted their quantified economy-wide emission reductions by 2020 or their national appropriate actions for mitigation until the January 31st, 2010 to the UNFCCC Secretariat. These are listed in Appendix XII.

8. Assessment of UNFCCC COP 15

8.1 Comparison: Copenhagen Accord vs. Three Different Approaches

If COP 15 can be considered as a successful conference to address climate change and to set the course to reduce global emissions significantly will be assessed in this chapter. The three in chapter 8 analyzed approaches to a post-2012 framework represent the basis for this assessment. These are subsequent compared and discussed with the “Copenhagen Accord”.

Legal Status of the COP 15 Outcome

Climate scientists, NGO-members and N. Stern claimed a legally binding status of the outcome of COP 15. Furthermore NGO-members described the character of the outcome as “*strong, equitable and global*” while N. Stern considered the character as “*effective and efficient*”. The COP 15 closing plenary “took note” with decision 1/CP.15, which means that this proposal is not off the table. It may represent a document for further negotiations. The “Copenhagen Accord” does not have a legal status and is therefore non- binding. Countries may support the content of the Accord, but all actions have a voluntary and not an obligating character. Therefore the COP 15 outcome did not meet the expectations of climate scientists, NGO-members and N. Stern, who claimed a legally binding agreement.

Global Mean Temperature

The opinions of climate scientists, NGO-members and N. Stern differed concerning the global mean temperature threshold. While climate scientists and NGO-members claimed to limit global warming at 1.5 or less-2°C or well below 2°C-2°C, N. Stern claimed the limitation at 2-2.5°C. The “Copenhagen Accord” implements a target “*to hold the increase in global temperature below 2 degrees Celsius*” (UNFCCC 2009c: 2). Furthermore the limitation of the global mean temperature at 1.5°C is contained as an option for reconsideration in 2015. These targets have to be considered as fictive targets due to the non-binding character of the “Copenhagen Accord”. Therefore the COP 15 outcome did not meet the expectations of climate scientists, NGO-members and N. Stern concerning a global mean temperature threshold.

Necessary Peak Emissions

Climate scientists had different opinions concerning the emission peak and stated that the emissions should peak in 2015-2020 and at latest in 2015. NGO-members share the last opinion while N. Stern described the necessary emission peak before 2023. The “Copenhagen Accord” refers to the IPCC AR4 and defines that “*We should cooperate in achieving the peaking of global and national emissions as soon as possible*” (UNFCCC 2009c: 2). This qualitative statement does not implement a concrete target – it remarks that emissions in developing countries will peak later as in developed countries. Although a qualitative target is implemented in the “Copenhagen Accord”, this target is fictive due to the non-binding character of the “Copenhagen Accord”. Therefore the COP 15 outcome did not meet the

opinions of climate scientists, NGO-members and N. Stern concerning the necessary emission peak.

Emission Reductions by 2020 and 2050

Climate scientists claimed global emission reductions of 40% by 2020 but had different opinions about emission reduction by 2050. Some claimed 50% reductions, others 80-95% by 2050 related to 1990-levels. Climate scientists see the requirement to reduce global emissions to 1 ton per capita and year by 2050 and a GHG stabilization level of 350ppm CO_2-eq. NGO-members claimed emission reductions of 40% by 2020 but opinions differed about emission reductions by 2050. Some claimed at least 80%, others 100% by 2050 related to 1990-levels. Furthermore NGO-members see the necessity, that non-Annex I countries should reduce their emissions by 15-30% related to the business-as-usual growth. Some NGO-members stated CO_2 stabilization level should be 350ppm, while others think the GHG stabilization level should be 350ppm. N. Stern claimed a global emission reduction of at least 50% by 2050, while Annex I countries should reduce 20-40% by 2020 and 80-90% of their emissions by 2050. Non-Annex I countries emission reductions should be defined in 2010-2020 and global per capita and year emissions should be limited at 1 ton by 2050 for a GHG stabilization level of 450-500ppm CO_2-eq.
The Copenhagen Accord does not contain quantified emission reductions. It describes the requirement that "*deep cuts in emissions are required*" (UNFCCC 2009c: 2) and refers to the IPCC AR4. The IPCC AR4 states that global emissions have to be reduced by 85% in 2050 and emissions should peak before 2015, if the global mean temperature increase should be limited at 2°C (see 3.3.3). None of these quantified targets are contained in the "Copenhagen Accord", but Annex I countries should submit their economy-wide emission reductions by 2020 and non-Annex I countries their national appropriate actions for mitigation. Annex I and non-Annex I countries have submitted their ambitions, but due to the non-binding character of the "Copenhagen Accord", these pledges are binding on national but not on international level. Therefore the COP 15 outcome did not meet the expectations of climate scientists NGO-members and N. Stern to agree binding global emission reductions by 2020 and/or 2050.

Financial Mechanisms

Climate scientists claimed a global carbon budget of 750Gt in 2000-2050 to limit global warming at 2°C. The peak and trade system should be based on a "one human – one emission" principle and furthermore be in accordance with commitment achievement plans (CAPs). The CDM should be replaced by funding due to the low environmental integrity and effectiveness. NGO-members decline carbon trading, because it delays the fossil fuel phase-out. The opinions differ concerning the CDM. Some stated that the CDM should be applied to LDCs while others see a complete abolishment of the CDM as necessary, because the CDM decelerates necessary shifts in economies and should be complemented by other measures. N. Stern claims an international carbon trading scheme from 2020-onwards and a continuation of the CDM but as a wholesale mechanism. The "Copenhagen Accord" states "*to pursue various approaches, including opportunities to use markets, to enhance the cost-*

effectiveness of, and to promote mitigation actions" (UNFCCC 2009c: 2). This means, that if the "Copenhagen Accord" became legally-binding, the IET, JI and CDM would be continued. Therefore, the "Copenhagen Accord", if legally binding, would meet the economic approach of Stern to the extent, that market-based mechanisms for mitigation are continued. But key elements concerning the technical design of these "*various approaches*" (UNFCCC 2009c: 2) are not clarified in the Accord – therefore it is impossible to define, if these "various approaches" are in line with the opinions of N. Stern or climate scientists. The "Copenhagen Accord" does not provide the possibility to act on carbon markets due to its non-binding status and has therefore no expressiveness concerning financial mechanism.

Funding

Climate scientists claimed a funding for adaptation and mitigation and a funding of at least 15 billion US$ by 2015 and 20 billion US$ by 2020 for research and development of low-carbon technologies. Furthermore this funding should replace the CDM. NGO-members claimed a funding of 20 billion US$ immediately and 100 billion US$ annually by 2020. Others stated that the funding should have the capacity of 140-200 billion US$ annually. N. Stern claimed a funding of at least 95 billion US$ by 2015 for research and development of low-carbon technologies, adaptation and development. The "Copenhagen Accord" establishes the Copenhagen Green Climate Fund, which should govern most of the financial resources that are defined to be provided by developed countries. 30 billion US$ in 2010-2012 and 100 billion US$ by 2020 should be provided by Annex I countries for adaptation and mitigation of climate change in countries that are vulnerable for climate change impacts. This funding is not legally binding due to the fact that the "Copenhagen Accord" does not represent a legally binding agreement. Therefore the "Copenhagen Accord" does not meet the expectations of climate scientists, NGO-members and N. Stern.

If the "Copenhagen Accord" was adapted as an agreement during the closing plenary of COP 15, only a few requirements of the three different approaches would have been fulfilled. The implementation of the target to limit global warming at 2°C would meet the approach of N. Stern completely and would scratch the upper limit of the climate-scientific and the non-governmental approach. The implementation of the Copenhagen Green Climate Fund to provide financial resources for adaptation and mitigation in developing (and especially vulnerable) countries matches almost completely with the three approaches. Some NGO-members claimed a financial capacity of 140-200 billion US$, which is higher than the defined 100 billion US$ by 2020 in the "Copenhagen Accord". The by N. Stern claimed implementation in 2015 is defined with in 2020 in the "Copenhagen Accord". The definition that "various approaches" are pursued to mitigate climate change matches to some extent with Sterns claim to continue the CDM, although his claimed shift from a project-based mechanism to a wholesale-mechanism is not included.
Table 8 presents a summarized comparison of key elements of the different approaches to a post-2012 framework and the "Copenhagen Accord". It is a modification of Table 7 to show, which elements of the approaches are fulfilled (green), not fulfilled (red) or would be fulfilled (yellow), if the COP 15 closing

plenary had adopted the “Copenhagen Accord”.

Table 8: Comparison of Approaches to a post-2012 Framework with the “Copenhagen Accord”

Criteria	Climate-Scientific Approach	Non-Governmental Approach	Economic Approach
Legal Status	Binding	Binding (strong, equitable, global)	Binding (effective and efficient)
Global Mean Temperature Threshold	1.5 or less – 2.0°C	well below 2°C - 2°C	2~2.5°C
Emission Peak	at latest in 2015; in 2015-2020	at latest 2015	before 2023
Emission Reductions Global by 2020 (Related to 1990-Levels)	40%	40%	-
Emission Reductions Global by 2050 (Related to 1990-Levels)	50%; 80-95%	at least 80%; 100%	at least 50%
Emission Reductions Annex I Countries by 2020	carbon budget approach: 750Gt CO_2 in 2000-2050; 75-80% of all mitigation	40%	20-40%
Emission Reductions Annex I Countries by 2050		-	80-90%
Developing Countries	-	15-30% related to business as usual growth	should be defined in 2010-2020
Per capita and year Emissions by 2050	1 ton	-	1 ton
CO_2 Stabilization Level	350ppm	350ppm	-
CO_2-eq Stabilization Level	-	350ppm	450-500ppm
Emission Cap and Trade	Peak and Trade System based on a carbon budget and a “one human – one emission right” distribution; Strategies for CAPs	Decline of Carbon Trading; Carbon Trading decelerates fossil-fuel phase-out	International Carbon Trading System with all countries included from 2020-onwards
CDM	Funding instead of CDM – low environmental integrity and effectiveness	CDM only applied to LDCs; Decline of CDM: CDM should be complemented by other measures; CDM delays necessary social shifts to low carbon economies	CDM should be continued – shift from project based to wholesale mechanism necessary, governed by IEA and WTO
Funding	Global public funding for R&D , adaptation and mitigation of at least 15 billion US$ by 2015 and 20 US$ by 2020;	20 billion US$ immediately; 100 billion US$ by 2020;140-200 billion US$ annually for adaptation and mitigation	at least 95 billion US$ by 2015 annually for R&D, deforestation and development

8.2 Discussion: Copenhagen Accord vs. Three Different Approaches

The outcome of COP 15, the “Copenhagen Accord”, does not match with any claimed element of the climate-scientific, non-governmental or economic approach. All elements, which are contained in the “Copenhagen Accord” are not legally binding and therefore do not represent any kind of agreement. Therefore nothing has been agreed during COP 15. Even if the “Copenhagen Accord” was adapted during COP 15, only a small amount of climate-scientific, non-governmental or economic claims would have been fulfilled. Neither the determination of the non-governmental approach “strong” (=ambitions emission targets to keep global warming below 2°C), “equitable” (=developed countries account for the majority of efforts of climate change mitigation) and “global” (=global defined emission reductions), nor N. Stern’s determinations “effective” (= safeguarding to achieve the emission reductions) and “efficient (=implementation of cost-effective mitigation mechanisms) match with the character of the “Copenhagen Accord”. The “Copenhagen Accord” implements the global mean temperature threshold value of 2°C, but neither a global emission cap nor a global emission reduction strategy or pathway is contained in the “Copenhagen Accord”. Therefore this threshold value represents a quantified target, which remains a theoretical goal in this document (paper tiger). The qualitative expressions “*peaking of global and national emissions as soon as possible”* (UNFCCC 2009c: 2) and “*deep cuts in global emissions are required*” (UNFCCC 2009c: 2) cannot be considered as a concrete target for achieving emission reductions and an emission peak. The per capita and year emissions by 2050 and the GHG stabilization levels are not fulfilled, if the “Copenhagen Accord” had a binding character, as well due to the missing global emission reduction target. The “Copenhagen Accord” establishes “*various approaches, including opportunities to use markets”* (UNFCCC 299c: 2), but this would, if the “Copenhagen Accord” was an agreement, only match with N. Stern’s claim to continue the CDM. The “Copenhagen Accord” neither responds to the by climate scientists proposed “peak and trade” system nor to the decline of carbon trading and the CDM, which is claimed by NGO-members. Concerning funding, the “Copenhagen Accord” would fulfill most of the claimed requirements of the three different approaches. Indeed the amount of provided funding is lower as claimed in the non-governmental approach and it will become entirely effective later, as N. Stern claimed, but the funding established in the “Copenhagen Accord” can be considered as more or less the only element, which is in line with the requirements of climate scientists, NGO-members and economists.

Therefore the “Copenhagen Accord” does not represent a global, strong, equitable, effective or efficient agreement, which addresses climate change in an ambitious way, if it was adapted during the COP 15 closing plenary.

8.3 Assessment of the Copenhagen Accord and its Consequences

COP 15 was defined as the finish line of the two-year comprehensive process, which has been established under the BAP. Therefore the COP 15 outcome represents the benchmark, on which it has to be defined, if the comprehensive process and COP 15 have been successful to point a global way to stop climate change.

Different Reactions to the Copenhagen Accord

COP 15 did not fulfill the various expectations of climate scientists, NGOs, economists, indigenous peoples, gender activists, business people and millions of the civil society who claimed a global deal on climate change. Bill McKibben (Founder of 350.org) stated: "*I think [the Copenhagen Accord] pretty much failed to take account of the latest science. Almost two thirds of countries endorsed a target of 350 p.p.m. - but it was the wrong two thirds, the poor and the vulnerable nations*" (Nature Reports Climate Change Vol. 4 2010). H. Schellnhuber (Potsdam Institute for Climate Impact Research) argued: "*the meeting made brutally clear, how little the respective sovereign states are willing to contribute to the well-being of humankind"* (Nature Reports Climate Change Vol. 4 2010). R. Pachauri (Chair of the IPCC) considered the "Copenhagen Accord" as a progress, because it includes at the first time a scientific target has been adopted as a political target (2°C global warming threshold), but he misses concrete values for emission reductions (Spiegel Online 2009d). N. Bassey (Friends of the Earth International) stated after the summit: *"Copenhagen has been an abject failure. Justice has not been done. By delaying action, rich countries have condemned millions of the world's poorest people to hunger, suffering and loss of life as climate change accelerates. The blame for this disastrous outcome is squarely on the developed nations"* (BBC 2009a). J. Sauven (Greenpeace UK) described the outcome of COP 15 as: "*The city of Copenhagen is a crime scene tonight, with the guilty men and women fleeing to the airport. […] It seems there are too few politicians in this world capable of looking beyond the horizon of their own narrow self-interest, let alone caring much for the millions of people who are facing down the threat of climate change"* (BBC 2009a). John Ashe (Chair of the Kyoto Protocol Talks) argued: "*Given where we started and the expectations for this conference, anything less than a legally binding and agreed outcome falls far short of the mark*" (BBC 2009a).

The reactions from political key players of developed countries are in general not as critical as these of climate scientists and NGOs. U.S. President Obama described the "Copenhagen Accord" as "*meaningful and unprecedented*" and stated: "*For the first time in history, all major economies have come together to accept their responsibility to take action to confront the threat of climate change"* (Nature News 2009). He further argues: "*We're going to have to build on the momentum that we've established here in Copenhagen to ensure that international action to significantly reduce emissions is sustained and sufficient over time"* (BBC 2009a). The French President Sarkozy said: "*The text we have is not perfect... If we had no deal, that would mean that two countries as important as India and China would be freed from any type of contract... the United States, which is not in Kyoto, would be free of any type of contract. That's why a contract is absolutely vital"* (BBC 2009a). But there were also some critical voices from developed countries. J. Barroso (EU Commission President) argued: "*I will not hide my disappointment regarding the non-binding nature of the agreement here. In that respect the document falls far short of our expectations"* (BBC 2009a).

Representatives of developing countries criticized the "Copenhagen Accord" much more than representatives of developed nations. S. Serra (Brazil's Climate Change Ambassador) said: "*It's very*

disappointing, I would say, but it is not a failure... if we agree to meet again and deal with the issues that are still pending. We have a big job ahead to avoid climate change through effective emissions reduction targets and this was not done here" (BBC 2009a). I. Fry (Chief Negotiator of Tuvalu) stated: "*It looks like we are being offered 30 pieces of silver to betray our people and our future*" (BBC 2009a).
D. Williams (Chair of AOSIS) considered the COP 15 negotiations as: "*We lost our vigorous commitment from other parties to [a temperature target of] 1.5C. We were not able to secure a legally binding outcome. We were not able to secure mid-term targets, a peaking year and many other factors that AOSIS believes is crucial to our survival"* (BBC 2009a). Only Z. Xie (Head of China's Delegation) considered the COP 15 outcome as positive: "*The meeting has had a positive result, everyone should be happy. After negotiations both sides have managed to preserve their bottom line. For the Chinese this was our sovereignty and our national interest"* (BBC 2009a).
UNFCCC Executive Secretary Y. de Boer described the COP 15 "*as a rollercoaster in many ways*" (UNFCCC 2009d). He stated that the "Copenhagen Accord" "*contains a number of very significant elements in terms of a maximum temperature increase goal [and represents] an impressive accord, but not an accord that is legally binding"* (UNFCCC 2009d). UN Secretary General Ban Ki-Moon described the Accord as: *"The Copenhagen Accord may not be everything that everyone hoped for, but this decision of the COP is an essential beginning"* (BBC 2009).

Climate-Scientific Assessments of the Copenhagen Accord and its Impacts

J. Rogelj and M. Meinshausen (Potsdam Institute for Climate Impact Research) have estimated the future GHG emissions based on the pledges, which are submitted to the "Copenhagen Accord". The scientists assume that countries will only meet the lower ends of their emission reduction targets, because the "Copenhagen Accord" does not obligate the countries to meet their targets. Based on this assumption, global GHG emission will increase by 10-20% up to 47.9 to 53.6Gt CO_2-eq by 2020 related to today's levels. But only 40-44Gt CO_2-eq are allowed be emitted by 2020, if the global warming should be kept below 2°C (Nature Vol. 464 2010: 1126). Therefore, if countries continue this emissions pathway, the global mean temperature is estimated with a probability greater than 50% to increase above 3°C by 2100 (Nature Vol. 464 2010: 1128). Rogelj and Meinshausen call the Copenhagen pledges *"paltry"* (Nature Vol. 464 2010: 1126) and describe that the emission reductions target of the USA represents a target only 3% below 1990-levels, the EU's 20% emission reduction target would lead to lower annual emission reductions rates than in average over the past 30 years and the pledges of China can be considered as a business-as-usual pathway (Nature Vol. 464 2010: 1126). Only the emission reduction targets of Japan and Norway are in line with the of the IPCC AR4 claimed range, which describes the necessity of a 25-40%-reduction of developed countries' emission by 2020 related to 1990-levels. The scientists expect the industrialized countries' emissions by 2020 in a range of 6.5% above or 15.6% below 1990-levels, depending on, how ambitious the reductions will be realized (Nature Vol. 464 2010: 1128). Sawin et al. (Sustainability Institute, Hartland and MIT, Boston) modeled the countries pledges of the "Copenhagen Accord" and concluded, that the global mean temperature could

increase up to 3.9°C by 2100 related to pre-industrial times (Sawin et al 2010: 1). Furthermore the scientists estimate a GHG concentration of 1015ppm CO_2-eq by 2100 with the confirmed proposals and a GHG concentration of 715ppm CO_2-eq or a global warming of 2.9°C, if the potential proposals will be realized (Sustainability Institute 2010). Figure 5 describes different emission scenarios and its impacts during the 21st-century based on the "Copenhagen Accord" pledges.

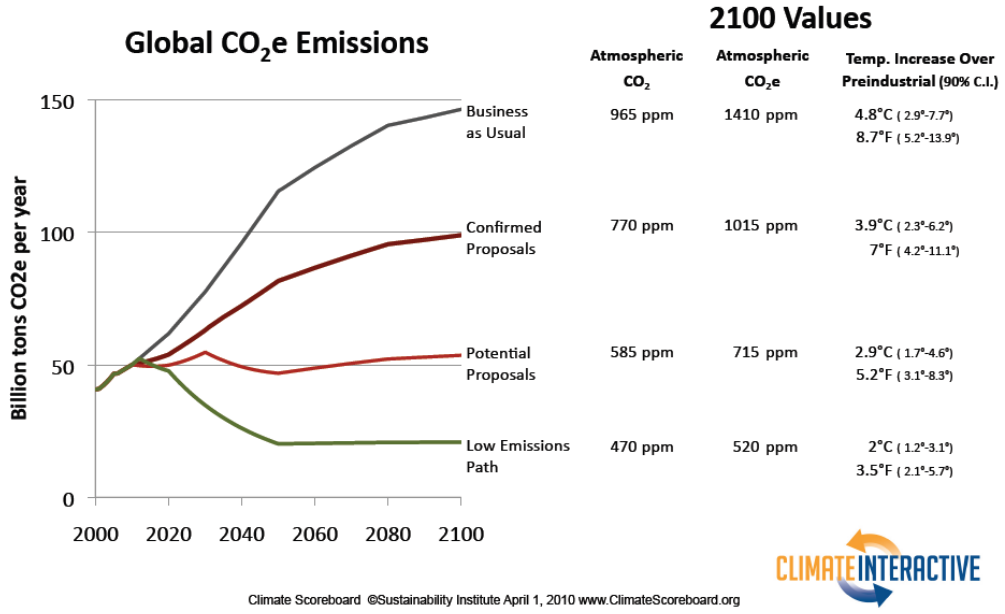

Figure 5: Outcome of the "Copenhagen Accord" pledges (Sustainability Institute 2010)

Therefore the emission reductions submitted to the "Copenhagen Accord" are far away from achieving to keep global warming below 2°C, which is defined as a goal in the "Copenhagen Accord".

The UK MetOffice has projected climate change impacts for a global mean temperature rise of 4°C above pre-industrial levels. These projections are very close to the projected global mean temperature increase of 3.9°C, if only the confirmed proposals will be realized. Every continent will be threatened by high forest-fire danger, especially regions such as large areas of the US, Mexico, South America, east of the Andes, southern and east Africa, the Sahel, Eastern and southern Australia and Europe. In low latitudes, maize and wheat yields will be reduced by 40%. The soybean production will decrease in South America, southern and eastern Asia, while the rice yields in China, India, Bangladesh and Indonesia decrease up to 30%. In the Mediterranean basin, southern Africa and large areas of South America the water resources will be shortened up to 70% in run-off. The Netherlands and south-eastern parts of the UK will be threatened by sea-level rise in combination with storm surges. The sea level could rise up to more than 80cm by the end of the 21st century, but – related to long-term research – a higher sea level is possible. Especially tropical islands and low-lying regions such as Bangladesh will suffer stronger from the sea-level rise. 150 million people per year will be seriously affected by floods caused by the sea level rise of 53cm until 2075. Glaciers in South America would melt completely while half of the Himalayan glaciers will decrease significantly. This will cause severe impacts on people in

Peru, India and China, who depend on rivers that content up to 75% glacier water (MetOffice 2009).
A strong acidification of the oceans will influence the fishing industry and reduce jobs in this sector. The biological balance in coral reefs and of commercial fish will be threatened by substantial changes of certain species in coral reefs. Droughts in the Mediterranean basin, southern Africa and South-East Asia will be twice as frequent while additional an almost complete disappearance of near-surface permafrost in Northern Siberia is stated. Canada and Alaska will recognize a significant reduce of permafrost in soils, which would cause an existential risk for constructions and communities in these regions. Because of acknowledges about the melting behavior of the western Antarctica and Greenland ice sheet, additional sea level rises of up to 3.3m (western Antarctica) and 7m (Greenland) by irreversible ice sheet declines could be possible. The intensity of tropical cyclones will increase due to a sea-level rise and to a global emerging population, especially in coastal regions. In highly populated regions, the temperatures on hottest days could rise to more than 6°C in eastern China, 8°C in Europe and 10-12°C in eastern North America (Toronto, Washington DC and New York). In Antarctic regions the averaged temperature will increase to 6-8°C while temperature will rise between 6-16°C in Arctic regions. A global averaged temperature increase of 4°C is comparable with a global averaged land-over temperature increase of 5.5°C (MetOffice 2009).

Conclusion

The climate change summit of Copenhagen or the fifteenth session of the Conference of Parties under the United Nations Framework Convention on Climate Change has failed entirely to address climate change in an ambitions way and to set the course for a long-term co-operative action to reduce global GHG emissions, to enhance sustainable development and to limit the impacts of climate change especially in countries that are vulnerable on climate change. Neither a legally binding agreement has been made, nor has this summit brought any remarkable step of progress towards climate stabilization at 1.5 or 2°C. Countries did not agree to implement a global emission reduction target and an emission reduction strategy. After Copenhagen the world is facing a global temperature increase of possible 3.9°C by 2100.
The Parties under the Convention did not meet their own target to "*reach an agreed outcome and adopt a decision at its fifteenth session*" (UNFCCC 2007b: 3) which is defined in the BAP. The under the BAP established building blocks have not been created to be adapted as a fragment of a post-2012 framework. The countries were not able to define a shared vision for long-term cooperative action, to agree on necessary mitigation and adaptation actions, to define the design and structure of financial and technology mechanisms and to enhance capacity building. The two-year process, which has been implemented under the BAP, has failed completely to deliver the agreement, which has been determined by the Parties as their overall target.
Furthermore the COP 15 outcome has neither fulfilled any element of the climate-scientific, non-governmental or economic approach, nor would the "Copenhagen Accord" match with many claims of these approaches, if it had been adopted and if it had a legally binding character. The three different

approaches, which represent three different social groups with partly extremely diverging opinions and attitudes, cover a wide range of global societies' expectations on COP 15. Therefore the global political level was not able to respond to at least some of these expectations and to deliver an outcome, which the political elite has promised in 2007 and millions of people hoped for.

Although the "Copenhagen Accord" implements the target to limit global warming at 2°C, which is supported by 133 countries that account for 86,2% of global GHG emissions (USCAN 2010), the submitted emission reduction plans will lead to a global GHG emissions increase of 10-20% by 2020 related to today's levels. Annex I countries, which entirely support the "Copenhagen Accord" and account for the major share of historical emissions, did not contribute their share to address climate change by submitting emission reduction targets that are ambitious enough to limit global warming at 2°C according to the scientific findings of the IPCC AR4. Therefore the gap of 1.9°C, which results as the difference between the determined 2°C-global warming limit and the estimated 3.9°C the world is heading to by 2100, represents an outcome of political incapability, to address climate change appropriately. Developing countries and especially the least developed countries will suffer the most from climate change impacts of a global temperature increase of 4°C, which are projected by the UK MetOffice. COP 15 was not able to agree to measures that enhance sustainable development worldwide and measures that provide appropriate support in adaptation and mitigation through financial resources and technology transfer. The Copenhagen Green Climate Fund, which has a "promising"-character due to its non-binding status, represents a starting point, but all actions are voluntary - not obligating - and furthermore it is not clarified, if the funding is allocated with other development actions. Therefore developed countries that account for 76% of all historical GHG emissions from 1850-2002 (Baumert et al. 2005: 32) did not provide appropriate measures to tackle the global problem climate change. Starkly expressed – developed countries do not only refuse their responsibility to approach a global problem appropriately for which they have the primary debt; developed counties as well accept tacitly, that billions of people in developing countries with limited capacities for climate change adaptation suffer significantly from climate change impacts.

In spite of the overall failure of COP 15, two positive aspects with a pedagogic character have to be stated as well. At first, COP 15 represented a landmark in history for climate change negotiations. The attendance of 115 Heads of State and Government has raised the importance of climate change as a global challenge on the highest possible political level. This can be considered as a signal, that many countries' governments including the USA (as the biggest industrial GHG emitting country and a country that has not ratified the Kyoto Protocol) have identified climate change as a crucial issue of the 21st century and see the necessity to act. Furthermore, the intensive media coverage in advance, during and after COP 15 as well as the dealing with climate change in advertisements e.g., has introduced climate change in broader public and in mainstream news, which is necessary to found a public basic knowledge and to sensibilize people for this crucial - but very abstract – topic.

9. Reasons for the Failure of Copenhagen

Several reasons have to be stated for the failure of COP 15. The reasons have to be analyzed in both in advance of COP 15 and during COP 15. Although the chance for an ambitious agreement was relatively small after the official pre-Copenhagen negotiations, some reasons have to be stated for the COP 15 negotiations, which made it additionally more difficult for Parties to reach an agreement.

Low Influence of Climate Scientists on Negotiation

The low or limited influence of climate scientists on the negotiations may represent one reason, why the climate summit of Copenhagen did not succeed with a strong agreement. The IPCC AR4, which has been published in 2007, has made it unequivocal clear, what kind of emission reduction levels and emission peaks for certain global mean temperature limitations have to be achieved. In spite of the clear message and explicit warnings that time is running out, especially developed countries did not offer ambitious enough emission reductions. Only Norway and Japan presented national climate policies, which are in line with the claims of the IPCC AR4 to reduce 25-40% of developed countries' emissions by 2020 related to 1990-levels to keep global warming below 2°C (Nature Vol. 464 2010: 1128). Developed countries did not offer or present emission reductions, which are in line with scientific findings and their self-defined target of the G8 summit in l'Aquila, Italia from July 2009, to limit global warming at 2°C (BBC 2009b). O. Edenhofer (Co-Chair of IPCC WG III) stated in advance of COP 15: *"I wouldn't say that I am depressed, but I feel very sad about the negotiation process as it stands now. But I don't see that this can be changed substantially by scientists"* (Nature Vol. 462 2010: 714).

The Working Process of the AWG-KP and AWG-LCA

The AWG-LCA was established under the BAP to conduct the two-year negotiations to deliver a document for adaptation at COP 15. But recently in advance of COP 15, the negotiation process of the AWG-LCA was far behind its schedule and far away from preparing finished options, of which ministers could choose on COP 15. At the latest, the last AWG-LCA meeting on the road to Copenhagen, the Barcelona Climate Talks in November 2009, have made it brutally clear, that COP 15 won't deliver the agreement, if not some unpredictable changes would happen (TIME Magazine 2009). Neither one of the building blocks have been realized, nor the Parties made consensus in key questions for a global agreement (Appleton et al. 2009c: 15). The negotiation text, a complex 200-pages document full of brackets represented the key element of the negotiations and Parties only made small progress in streamlining the text due to very different positions in key questions (Appleton et al 2009c: 1, 15-16).
Mistrust, polarization, frustration and divergent interest have dominated the road to Copenhagen and finally led to the suspension of the AWG-KP by the African Group and some supporting developing countries, which stated not to continue its work, until the Annex I emission targets are agreed (Appleton et al. 2009: 16).

Therefore it is questionable, if the two-track approach (AWG-LCA and AWG-KP) represented an efficient strategy to conduct the negotiations towards Copenhagen, or if a single-track approach would have made it easier to determine the realization of the BAP building blocks. Furthermore the methodology of the two-track approach has to be reconsidered as well. The top-down strategy ("*nothing is agreed until everything is agreed*" (Appleton et al 2009d: 18)) to work on a comprehensive but very complex text has led to complex and deadlocked negotiations (Ecopolity 2009). Therefore a bottom-up approach, to start with minimal consensus as a fundament and to continue the negotiations step-by-step, might represent a more promising strategy.

North vs. South: Climate (In-)Justice

The southern hemisphere, in which mainly developing countries are located, suffers more from climate change impacts and has limited capacities for adaptation. Countries which are located in the northern hemisphere represent mainly rich and developed nations with good capacities in adaptation, financial and technical resources for mitigation and significant knowledge and expertise in several academic disciplines (Roberts et al. 2007: 28). The North, which accounts for 76% of all historical emissions (Baumert et al. 2005: 32) did not offer adequate emission reduction targets, financial resources and technology for adaptation, mitigation and sustainable development, which were accepted by developing country Parties. Developing country Parties urged Annex I countries to put more ambitious emission reduction targets on the table – without remarkable progress (Appleton et al. 2009c: 4-5). Furthermore, more than 100 developing countries of AOSIS and G77 claimed a global warming limitation of 1.5°C (Guardian 2009d), but finally the developed countries, which are 41 in total, have forced their point to implement their proposed target, the 2°C threshold value, as a political target in the "Copenhagen Accord" (UNFCCC 2009c: 1). The since 20 years existing and well-established practices in climate negotiations, that developed countries do not offer a huge ranges of possibilities for decision-making (Roberts et al. 2007: 5), have led to a polarization of rich against poor, developed against developing countries or "North vs. South". The resulting mistrust and frustration, which led to the suspension of the AWG-KP negotiations in Barcelona, can be related directly to the North vs. South-polarization, which and represents an important reason, why pre-Copenhagen negotiations were almost deadlocked.

US Climate Policy and US Emission Reduction Targets by 2020

The USA as the biggest historical GHG emitter, with a responsibility of 29.3% of all historical emissions in 1850-2002, has put an offer of 17% emission reductions by 2020 related to 2005-levels or 3% related to 1990-levels on the table (Nature Vol. 464 2010: 1126). As mentioned many times above, the IPCC claimed a 25-40% reduction by 2020 of all developed countries. The US Climate Act "The Cap and Trade Bill HR 2454", which did not pass the US Senate in advance of Copenhagen due to some Republican resistance (Guardian 2009e), included a 20% emission reduction by 2020 related to 2005-levels. Therefore US President Obama was just able to present the 17% emission reduction, which has been considered as a very unabitious target (Guardian 2009e; Nature Vol. 464 2010: 1126). The

chances for an ambitious global outcome of COP did not increase with these emission reduction pledges of the USA.

China and India blocked the Conference

China and India, two vastly developing nations with significant increasing GHG emissions, did neither put absolute emission reductions on the table nor behaved productive during the two weeks of COP 15 (Guardian 2009g). Although China currently accounts for the biggest GHG emission, it convened on its rights as a developing Party and on the "common but differentiated responsibilities". Therefore the Chinese delegation did not see any reason to make commitments (Guardian 2009g). In closed multilateral negotiations during the high-level segment, China's representative responded with the historical responsibility of Annex I countries to the claims of developed countries' Heads of State to make pledges as the biggest GHG emitting country. Indian's Prime Minister Singh, who shared the points of view of the Chinese delegation, blamed the German chancellor Merkel for pre-judging options (Guardian 2010). China's primary interest is to become the economic superpower of the 21st century while their economy growth and huge energy demand is mainly based on cheap domestic coal (Guardian2009g). An ambitious climate deal might harm the growth plans of China to some extent, therefore China has not had a big interest to seal the deal and behaved counterproductive for achieving an agreed target (Guardian 2009g). This is the reason, why the US, India, China, Brazil and South Africa deleted the global emission reduction target of the "Copenhagen Accord" subsequent to the multilateral negotiations with EU countries in the afternoon of December 18th, 2009 (Spiegel 2010).

Organization and Administration of COP 15 by Denmark as the Hosting Country

The Danish COP Presidency under C. Hedegaard has been very ambitious and motivated in advance of COP 15 to promote climate change as a crucial issue in public, to convince governments to make more ambitious pledges and to show global leaders the direct impacts of climate change. But mistakes have been made during the two-weeks of the COP 15. It seemed that Denmark wanted to mark its place in history as the hosting country of this important conference. Therefore an agreement – the more ambitious, the better – was needed. While recognizing that the negotiations were deadlocked during the first week of COP 15 (Ecopolity 2009), the Danish COP Presidency introduced the "Danish Text", which has been considered as very undemocratic by developing countries. The negotiations about the continuation in informal contact groups have cost one day of valuable negotiation time without making any progress (Appleton et al. 2009d: 28).

Furthermore, the Danish Prime Minister L. Rasmussen did not behave very sovereign as the COP President during the high-level segment. His efforts to conduct the negotiations in the "friends of the Chair" group have been considered as less transparent and undemocratic by some developing countries (Appleton et al 2009d: 28). The methodology according to UN-principles to include all Parties in the negotiations was changed into multilateral negotiations with a group of selected countries. This

measure, although it made progress in drafting the “Copenhagen Accord”, did not increase the trust of many countries in the COP Presidency.

COP President Rasmussen opened the closing plenary after the delegates had waited for about five hours. He did not give any reason, just announced that the deal was done and offered one hour for consultation (Guardian 2009h). He furthermore ignored UN-principles, which allow every country to comment, ask for clarification or share their point of view in advance of a vote (Guardian 2009h). Parties were just able to ask for points of order and were only recognized, when they hit with their name-plates on their table (Guardian 2009h). His subsequent urges to the COP to adapt the “Copenhagen Accord” were considered by many Parties as far away from UN-procedures and are not in accordance with the COP President as an independent panel chair (see 2.2.4).

Concluding, the behavior of the Danish COP Presidency has destroyed some trust in achieving a positive COP 15 outcome and has put additional obstacles in the way towards an agreement. The shifts away from UN-multilateralism in negotiations to less transparent negotiations and his for a COP President “unconventional” behavior in the closing plenary represent reasons, why the COP 15 failed.

UNFCCC Draft Rules of Procedure

As described in 2.2.4, the draft rules of procedure require a consensus of all Parties in the COP to adopt a decision or to make an agreement. If one Party does not support the proposal, the decision cannot be adopted. Therefore it is very difficult for countries to adopt decisions, because every Party has to support the decision. The “Copenhagen Accord”, although it does not represent a strong proposal for an agreement, has not been adopted due to the resistance of a small amount of developing countries as Venezuela, Bolivia, Cuba and Nicaragua (Appleton et al. 2009: 28). A majority resolution of 50%, 66% or 75% e.g. would make it easier to make an agreement or to adapt decisions, although some countries may feel disadvantaged due to the missing veto-right.

10. Post-Copenhagen Climate Negotiations

COP 15 has failed to set the course for a strong and ambitious agreement to address climate change and to enhance sustainable development. Therefore climate change negotiations under the UNFCCC have continued. The mandate for the AWG-LCA has been enlarged for one year until the COP 16 in Cancun, Mexico in December 2010 (UNFCCC 2010n). In April 2010, the AWG-LCA and the AWG-KP met to discuss and announce their schedules for the negotiations until COP 16.

At the beginning of May 2010, the German chancellor invited 40 environmental ministers to discuss the necessity of ambitious emission reduction targets at the "Petersberger Klimadialog" (Petersberg Climate Dialogue) (Spiegel Online 2010a). This informal summit did not make progress in achieving an agreement directly, but countries discussed necessary next steps towards Cancun and rehabilitated at least partly the lost trust from Copenhagen (Zeit Online 2010). But Y. de Boer, UNFCCC Executive Secretary, curbed the expectations for achieving an agreement in Cancun. He stated after the Petersberg Climate Dialogue that he has recognized a will to enhance climate protection jointly, but he does not expect COP 16 to finish with an agreement. He furthermore hopes that Cancun will set an efficient frame for an agreement (Zeit Online 2010).

COP 16 in December 2010 in Cancun might potentially determine if climate protection will be tackled jointly under the umbrella of the UNFCCC or if climate policy is too complex to be solved globally in consensus. If this is the case, countries' emission pathways primary depend on national climate policies and are not controlled by multilateral institutions. But if COP 16 is capable of making significant progress in climate protection and if countries are capable of agreeing at least to a frame which sets the basis for a global agreement on climate change, the chances might be high that countries will find sooner or later consensus under the UNFCCC. But if the AWG-LCA negotiations remain as deadlocked as in Copenhagen, it might be more likely that either only a weak agreement or no agreement at all will be achieved.

But it won't be enough to only make an agreement which implements a global warming threshold value and defines emission reductions of developed and developing countries. Implementing a successful climate policy requires more. Cultural paradigms especially in our highly developed Western society need substantial shifts towards sustainable acting. The over-consumption of resources, the destruction of ecosystems to secure and increase our living standards, and the indefinite economic growth (which is based on limited resources) have to be turned into responsible economic behavior, which are in tune with the balance of nature. Therefore, the above mentioned shifts in cultural paradigms towards sustainability are necessary on many different social layers. But this cannot be solved on the political level - a broad public understanding of the challenge we are facing is necessary. Widespread public education in consumerism and sustainability are therefore needed, as well as incentives to consciously make people's lifestyles as eco-friendly as possible. The earlier and the more comprehensive this is achieved, the higher the chances are to conserve our biodiversity, our ecosystems and our livelihoods for future generations.

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Photos

All photos in this Bachelor's Thesis are taken by Martin Kaltenbacher during COP 15, the Climate Action Day and Klimaforum09 in Copenhagen, Denmark in December 2009. The photos are provided by Martin Kaltenbacher and represent his intellectual property.

Appendix

Appendix I

List of Annex I Countries to the Convention (UNFCCC 2006: 46)

Box 3.1: Annex I to the Convention

Australia	Greece	Portugal
Austria	Hungary[a]	Romania[a]
Belarus[a]	Iceland	Russian Federation[a]
Belgium	Ireland	Slovakia[a] *
Bulgaria[a]	Italy	Slovenia[a] *
Canada	Japan	Spain
Croatia[a] *	Latvia[a]	Sweden
Czech Republic[a] *	Liechtenstein*	Switzerland
Denmark	Lithuania[a]	Turkey
European Economic Community	Luxembourg	Ukraine[a]
Estonia[a]	Monaco*	United Kingdom of Great Britain and Northern Ireland
Finland	Netherlands	United States of America
France	New Zealand	
Germany	Norway	
	Poland[a]	

[a] Countries that are undergoing the process of transition to a market economy.

** Publisher's note: Countries added to Annex I by an amendment that entered into force on 13 August 1998, pursuant to decision 4/CP.3 adopted at COP.3.*

Appendix II

List of Annex I Countries to the Convention (UNFCCC 2006: 47)

Box 3.2: Annex II to the Convention

Australia	Iceland	Sweden
Austria	Ireland	Switzerland
Belgium	Italy	United Kingdom of Great Britain and Northern Ireland
Canada	Japan	
Denmark	Luxembourg	United States of America
European Economic Community	Netherlands	
Finland	New Zealand	
France	Norway	
Germany	Portugal	
Greece	Spain	

Publisher's note: Turkey was deleted from Annex II by an amendment that entered into force 28 June 2002, pursuant to decision 26/CP.7 adopted at COP.7.

Appendix III

List of Annex I Countries to the Convention (UNFCCC 2006: 48)

Box 3.3: Countries with economies in Transition

Belarus	Hungary	Russian Federation
Bulgaria	Latvia	Slovakia
Croatia	Lithuania	Slovenia
Czech Republic	Poland	Ukraine
Estonia	Romania	

Appendix IV

Emission Scenarios (IPCC 2007a: 18)

THE EMISSION SCENARIOS OF THE IPCC SPECIAL REPORT ON EMISSION SCENARIOS (SRES)[17]

A1. The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil-intensive (A1FI), non-fossil energy sources (A1T) or a balance across all sources (A1B) (where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end use technologies).

A2. The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing population. Economic development is primarily regionally oriented and per capita economic growth and technological change more fragmented and slower than other storylines.

B1. The B1 storyline and scenario family describes a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives.

B2. The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social and environmental sustainability. It is a world with continuously increasing global population, at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented towards environmental protection and social equity, it focuses on local and regional levels.

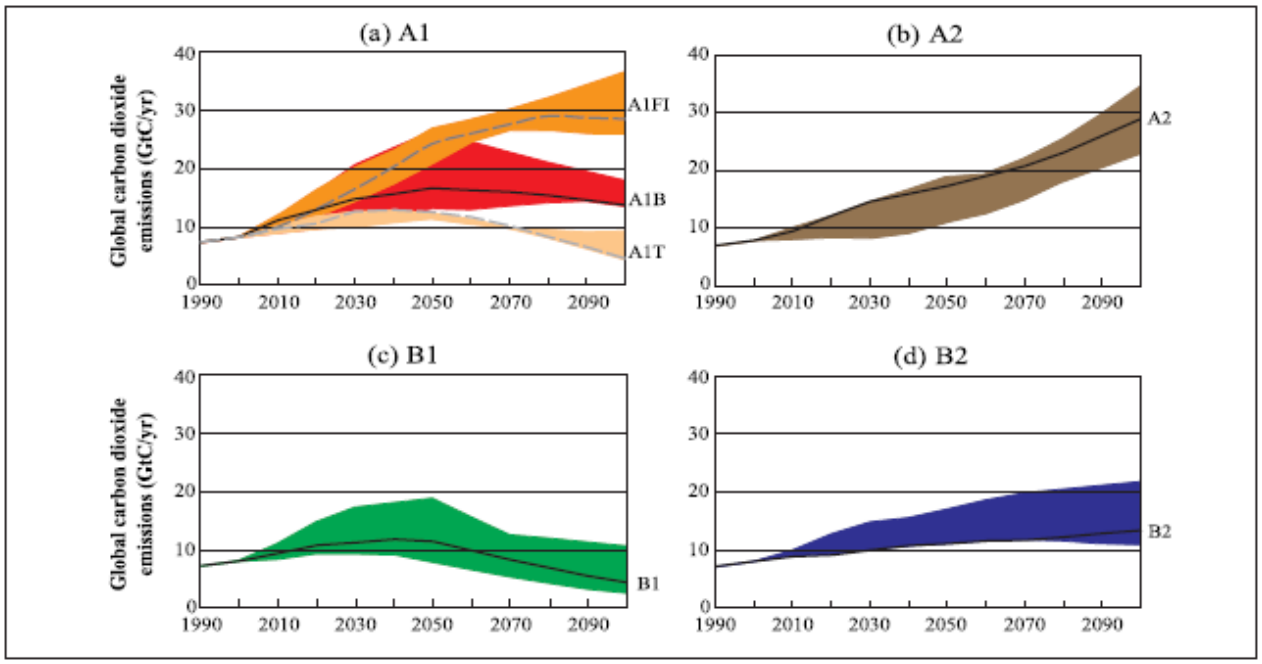
An illustrative scenario was chosen for each of the six scenario groups A1B, A1FI, A1T, A2, B1 and B2. All should be considered equally sound.

The SRES scenarios do not include additional climate initiatives, which means that no scenarios are included that explicitly assume implementation of the United Nations Framework Convention on Climate Change or the emissions targets of the Kyoto Protocol.

[17] Emission scenarios are not assessed in this Working Group I Report of the IPCC. This box summarising the SRES scenarios is taken from the TAR and has been subject to prior line-by-line approval by the Panel.

Appendix V

SRES Carbon Dioxide Emissions (IPCC 2000: 8)



Appendix VI

IPCC-Definitions of Likelihoods of Results (IPCC 2007b: 23)

The standard terms used in this report to define the likelihood of an outcome or result where this can be estimated probabilistically are:

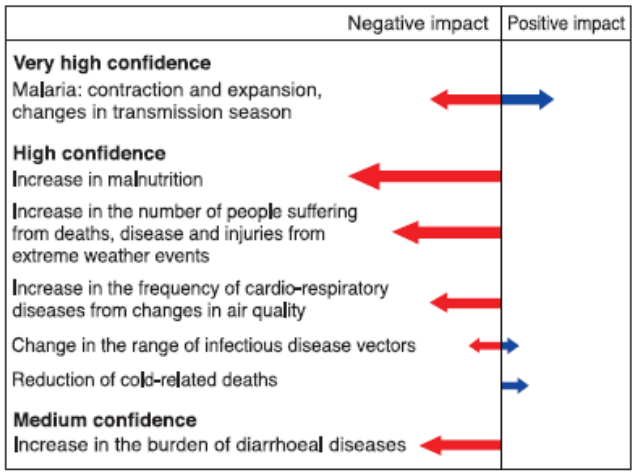
Likelihood Terminology	Likelihood of the occurrence/ outcome
Virtually certain	> 99% probability
Extremely likely	> 95% probability
Very likely	> 90% probability
Likely	> 66% probability
More likely than not	> 50% probability
About as likely as not	33 to 66% probability
Unlikely	< 33% probability
Very unlikely	< 10% probability
Extremely unlikely	< 5% probability
Exceptionally unlikely	< 1% probability

The terms 'extremely likely', 'extremely unlikely' and 'more likely than not' as defined above have been added to those given in the IPCC Uncertainty Guidance Note in order to provide a more specific assessment of aspects including attribution and radiative forcing.

Unless noted otherwise, values given in this report are assessed best estimates and their uncertainty ranges are 90% confidence intervals (i.e., there is an estimated 5% likelihood of the value being below the lower end of the range or above the upper end of the range). Note that in some cases the nature of the constraints on a value, or other information available, may indicate an asymmetric distribution of the uncertainty range around a best estimate. In such cases, the uncertainty range is given in square brackets following the best estimate.

Appendix VII

Climate Change Impacts on Selected Heath Issues (IPCC 2007d: 43)



Appendix VIII

Key Mitigation Technologies and Practices by Sector (IPCC 2007e: 10)

Sector	**Key mitigation technologies and practices currently commercially available**	**Key mitigation technologies and practices projected to be commercialized before 2030**
Energy supply [4.3, 4.4]	Improved supply and distribution efficiency; fuel switching from coal to gas; nuclear power; renewable heat and power (hydropower, solar, wind, geothermal and bioenergy); combined heat and power; early applications of Carbon Capture and Storage (CCS, e.g. storage of removed CO_2 from natural gas).	CCS for gas, biomass and coal-fired electricity generating facilities; advanced nuclear power; advanced renewable energy, including tidal and waves energy, concentrating solar, and solar PV.
Transport [5.4]	More fuel efficient vehicles; hybrid vehicles; cleaner diesel vehicles; biofuels; modal shifts from road transport to rail and public transport systems; non-motorised transport (cycling, walking); land-use and transport planning.	Second generation biofuels; higher efficiency aircraft; advanced electric and hybrid vehicles with more powerful and reliable batteries.
Buildings [6.5]	Efficient lighting and daylighting; more efficient electrical appliances and heating and cooling devices; improved cook stoves, improved insulation ; passive and active solar design for heating and cooling; alternative refrigeration fluids, recovery and recycle of fluorinated gases.	Integrated design of commercial buildings including technologies, such as intelligent meters that provide feedback and control; solar PV integrated in buildings.
Industry [7.5]	More efficient end-use electrical equipment; heat and power recovery; material recycling and substitution; control of non-CO_2 gas emissions; and a wide array of process-specific technologies.	Advanced energy efficiency; CCS for cement, ammonia, and iron manufacture; inert electrodes for aluminium manufacture.
Agriculture [8.4]	Improved crop and grazing land management to increase soil carbon storage; restoration of cultivated peaty soils and degraded lands; improved rice cultivation techniques and livestock and manure management to reduce CH_4 emissions; improved nitrogen fertilizer application techniques to reduce N_2O emissions; dedicated energy crops to replace fossil fuel use; improved energy efficiency.	Improvements of crops yields.
Forestry/forests [9.4]	Afforestation; reforestation; forest management; reduced deforestation; harvested wood product management; use of forestry products for bioenergy to replace fossil fuel use.	Tree species improvement to increase biomass productivity and carbon sequestration. Improved remote sensing technologies for analysis of vegetation/ soil carbon sequestration potential and mapping land use change.
Waste management [10.4]	Landfill methane recovery; waste incineration with energy recovery; composting of organic waste; controlled waste water treatment; recycling and waste minimization.	Biocovers and biofilters to optimize CH_4 oxidation.

Appendix IX

Climate Change Mitigation Policies by Sector (IPCC 2007e: 20)

Sector	Policies[a], measures and instruments shown to be environmentally effective	Key constraints or opportunities
Energy supply [4.5]	Reduction of fossil fuel subsidies Taxes or carbon charges on fossil fuels	Resistance by vested interests may make them difficult to implement
	Feed-in tariffs for renewable energy technologies Renewable energy obligations Producer subsidies	May be appropriate to create markets for low emissions technologies
Transport [5.5]	Mandatory fuel economy, biofuel blending and CO_2 standards for road transport	Partial coverage of vehicle fleet may limit effectiveness
	Taxes on vehicle purchase, registration, use and motor fuels, road and parking pricing	Effectiveness may drop with higher incomes
	Influence mobility needs through land use regulations, and infrastructure planning Investment in attractive public transport facilities and non-motorised forms of transport	Particularly appropriate for countries that are building up their transportation systems
Buildings [6.8]	Appliance standards and labelling	Periodic revision of standards needed
	Building codes and certification	Attractive for new buildings. Enforcement can be difficult
	Demand-side management programmes	Need for regulations so that utilities may profit
	Public sector leadership programmes, including procurement	Government purchasing can expand demand for energy-efficient products
	Incentives for energy service companies (ESCOs)	Success factor: Access to third party financing
Industry [7.9]	Provision of benchmark information Performance standards Subsidies, tax credits	May be appropriate to stimulate technology uptake. Stability of national policy important in view of international competitiveness
	Tradable permits	Predictable allocation mechanisms and stable price signals important for investments
	Voluntary agreements	Success factors include: clear targets, a baseline scenario, third party involvement in design and review and formal provisions of monitoring, close cooperation between government and industry
Agriculture [8.6, 8.7, 8.8]	Financial incentives and regulations for improved land management, maintaining soil carbon content, efficient use of fertilizers and irrigation	May encourage synergy with sustainable development and with reducing vulnerability to climate change, thereby overcoming barriers to implementation
Forestry/ forests [9.6]	Financial incentives (national and international) to increase forest area, to reduce deforestation, and to maintain and manage forests	Constraints include lack of investment capital and land tenure issues. Can help poverty alleviation
	Land use regulation and enforcement	
Waste management [10.5]	Financial incentives for improved waste and wastewater management	May stimulate technology diffusion
	Renewable energy incentives or obligations	Local availability of low-cost fuel
	Waste management regulations	Most effectively applied at national level with enforcement strategies

Appendix X

List of Annex I Parties under the Kyoto Protocol and their Commitments (UNFCCC 1997b: 20)

Annex B

Party	Quantified emission limitation or reduction commitment (percentage of base year or period)
Australia	108
Austria	92
Belgium	92
Bulgaria*	92
Canada	94
Croatia*	95
Czech Republic*	92
Denmark	92
Estonia*	92
European Community	92
Finland	92
France	92
Germany	92
Greece	92
Hungary*	94
Iceland	110
Ireland	92
Italy	92
Japan	94
Latvia*	92
Liechtenstein	92
Lithuania*	92
Luxembourg	92
Monaco	92
Netherlands	92
New Zealand	100
Norway	101
Poland*	94
Portugal	92
Romania*	92
Russian Federation*	100
Slovakia*	92
Slovenia*	92
Spain	92
Sweden	92
Switzerland	92
Ukraine*	100
United Kingdom of Great Britain and Northern Ireland	92
United States of America	93

* Countries that are undergoing the process of transition to a market economy.

Appendix XI

Development of Annex I Parties' GHG Emissions between 1990 and 2007 (UNFCCC 2009a: 16)

Table 4. Total aggregate anthropogenic emissions of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 excluding emissions/removals from land use, land-use change and forestry, 1990, 2000 and 2005–2007

	Gg CO_2 equivalent					Change from 1990 to 2007
Party	1990	2000	2005	2006	2007	(%)
Australia	416 214	494 855	524 635	534 471	541 179	30.0
Austria	79 037	81 078	92 832	91 518	87 958	11.3
Belarus*	129 129	70 995	77 435	81 332	80 010	–38.0
Belgium	143 249	145 100	141 919	136 612	131 301	–8.3
Bulgaria**	133 747	69 223	71 027	71 936	75 793	–43.3
Canada	591 793	717 101	730 967	718 178	747 041	26.2
Croatia*	31 374	25 955	30 433	30 769	32 385	3.2
Czech Republic*	194 712	147 234	146 249	149 107	150 823	–22.5
Denmark	70 414	69 167	64 902	72 500	68 092	–3.3
Estonia*	41 935	18 379	19 637	19 180	22 019	–47.5
European Community[b]	4 232 900	4 107 639	4 141 348	4 115 962	4 051 964	–4.3
Finland	70 862	69 544	68 696	79 935	78 345	10.6
France	565 495	560 581	558 445	546 371	535 772	–5.3
Germany	1 215 209	1 008 164	968 893	980 005	956 113	–21.3
Greece	105 562	127 126	131 831	128 089	131 854	24.9
Hungary**	116 453	78 016	80 382	78 865	75 944	–34.8
Iceland	3 400	3 730	3 694	4 236	4 482	31.8
Ireland	55 383	68 951	70 258	69 682	69 205	25.0
Italy	516 318	549 509	573 685	562 982	552 771	7.1
Japan	1 269 657	1 345 997	1 357 844	1 342 109	1 374 256	8.2
Latvia*	26 679	10 103	11 213	11 671	12 083	–54.7
Liechtenstein	230	255	271	273	243	6.1
Lithuania*	49 075	19 186	22 563	22 874	24 738	–49.6
Luxembourg	13 118	9 971	13 391	13 304	12 914	–1.6
Monaco	108	120	104	93	98	–9.3
Netherlands	211 997	214 427	212 182	208 508	207 504	–2.1
New Zealand	61 853	70 598	77 175	77 599	75 550	22.1
Norway	49 695	53 358	53 701	53 470	55 050	10.8
Poland**	569 510	389 011	386 608	399 292	398 881	–30.0
Portugal	59 269	81 710	89 229	84 694	81 841	38.1
Romania**	276 050	135 524	149 380	153 840	152 290	–44.8
Russian Federation*	3 319 327	2 030 431	2 117 821	2 185 883	2 192 818	–33.9
Slovakia*	73 255	48 424	49 375	48 938	46 951	–35.9
Slovenia**	20 340	18 912	20 377	20 570	20 722	1.9
Spain	288 135	385 768	441 150	433 070	442 322	53.5
Sweden	71 934	68 159	67 200	66 870	65 412	–9.1
Switzerland	52 709	51 648	53 665	53 173	51 265	–2.7
Turkey**	170 059	279 956	312 420	332 675	372 638	119.1
Ukraine*	926 033	389 714	417 529	436 767	436 005	–52.9
United Kingdom	774 164	677 138	656 140	651 444	640 273	–17.3
United States	6 084 490	6 975 180	7 082 213	7 006 049	7 107 162	16.8
Number of Parties showing decrease in emissions by more than 1 per cent:	*23*					
Number of Parties showing change in emissions within 1 per cent:	*0*					
Number of Parties showing increase in emissions by more than 1 per cent:	*18*					

[a] Data for the base year defined by decisions 9/CP.2 and 11/CP.4 (Bulgaria (1988), Hungary (average of 1985–1987), Poland (1988), Romania (1989), Slovenia (1986)) are used for this Party instead of 1990 data.

[b] Emission estimates of the European Community are reported separately from those of its member States.

* A Party undergoing the process of transition to a market economy.

** Decision 26/CP.7 invited Parties to recognize the special circumstances of Turkey, which place Turkey in a situation different from that of other Annex I Parties.

Appendix XII

"Copenhagen Accord" Pledges (Sustainability Institute 2010a)

Publicly Reported Proposals to UNFCCC's COP-15
as Interpreted by Sustainability Institute, April 1, 2010

Country/Region	Reduction in Emissions 2020	2050	Other Proposals
Argentina			*Zero deforestation by 2020*
Australia	5% below 2000 *25% below 2000*	60% below 2000	20% renewable energy by 2020
Belarus	*10% below 1990*		
Brazil	36.1% below BAU *38.9% below BAU*		Amazon deforestation rate 70% below 2009 levels by 2017 *Zero deforestation by 2020*
Canada	17% below 2005	60% below 2006 *70% below 2006*	
China	carbon intensity 45% below 2005		Increase forest coverage by 40 million hectares by 2020; increase proportion of non-fossil fuels to 15% by 2020 *Emissions Peak in 2030 and fall to 2005 levels by 2050*
Costa Rica			0 emissions by 2021
Croatia	5% below 1990		
EU-27	20% below 1990 *30% below 1990*	80% below 1990 *95% below 1990*	
Finland*		80% below 1990	
Germany*	40% below 1990		
Great Britain*	34% below 1990	80% below 1990	
Iceland	15% below 1990 *30% below 1990*	50% below 1990 *75% below 1990*	
India	carbon intensity 20% below 2005		Keep emissions per capita below those of developed countries *20% of electricity from renewable energy by 2020*
Indonesia	26% below BAU		*40% below 2005 by 2030; Change forest to net sink by 2030*
Israel	20% below BAU		
Japan	*25% below 1990*	*80% below 2005*	
Jordan			10% renewable energy by 2020
Kazakhstan	15% of 1992		
Liechtenstein	20% below 1990 *30% below 1990*		
Malaysia	carbon intensity 40% below 2005		
Maldives	carbon neutral		
Marshall Islands	*40% below 2009*		
Mexico	*30% below BAU*	*50% below 2002*	8% below 2009 by 2012
Moldova	25% below 1990		
Monaco	30% below 1990	carbon neutral	
Morocco			600% increase in wind power and 15% reduction in building, industry, and transport energy use by 2020
New Zealand	*20% below 1990*	50% below 1990	
Norway	30% below 1990 *40% below 1990*		*carbon neutral by 2030*
Papua New Guinea		*carbon neutral*	*50% below BAU by 2030*
Paraguay			*Zero deforestation by 2020*
Russia	15% below 1990 *25% below 1990*	50% below 1990	
Scotland*	42% below 1990	80% below 1990	
Singapore	*16% below BAU*		
South Africa	*34% below BAU*		Emissions peak in 2025, stabilize for 10 years and decline *42% below BAU by 2025*
South Korea	*30% below BAU*		
Switzerland	20% below 1990 *30% below 1990*		*carbon neutral by 2030*
Ukraine	*20% below 1990*	*50% below 1990*	
US	17% below 2005 *28% below 2005*	*75% below 2005*	

* Countries are part of EU-27

Black text indicates a confirmed proposal; *green italic* text indicates a potential proposal. Confirmed proposals include official gov't statements, adopted legislation, and UNFCC submissions. Potential proposals include conditional proposals, legislation under consideration, and unofficial government statements.

Appendix XIII

Questionnaire

QUESTIONNAIRE FOR BACHELOR THESIS

"Evaluation of the Climate Change Negotiations COP15 in Copenhagen (7.-18.12.09): Expectations, Results and Future Prospect" (working title)

Dear Interviewee!

Thanks a lot for taking the time to fill out this questionnaire.

I'm a 4th-year exchange and BA-degree student of "Environmental Engineering" from Germany and I'm finishing my BA-studies at University of Applied Sciences TAMK Tampere, Finland.

In my final thesis I'm planning to evaluate the outcome of UNFCCC COP15. Therefore I want to compare climate experts' expectations with the results and agreements of COP15.

While answering to the questions, please pay attention on the following aspects:

- To answer please mark you answer with an "X" in the brackets [ ]
- If necessary, feel free to mark more than one answer!
- Leave questions unacknowledged (if necessary)!

THANK YOU!

Malte Gebler

1. PERSONAL INFORMATION

1.1 Define Your Field of Work:

- Campaigner [ ]
- Lecturer [ ]
- NGO Member [ ]
- PhD-Student [ ]
- Professor [ ]
- Researcher (Institute) [ ]
- Researcher (NGO) [ ]
- Other:

1.2 State your Field of Expertise:

• Climate Change	[ ]	Development Policy	[ ]
• Environmental Economics	[ ]	Emission Trading	[ ]
• Environmental Policy	[ ]	Energy Policy	[ ]
• Forestry / Deforestation	[ ]	International Relations	[ ]
• Natural Science(s)	[ ]	Renewable Technologies	[ ]
• Others:			

1.3 Name of Entrepreneur:

- Research Centre:
- NGO:
- University:
- Other:

2. CLIMATE CHANGE

2.1 Global Mean Temperature

To guard the world against the risks of catastrophic climate change the relative increase of the Global Mean Temperature (related to the level of the year 1900) has to be kept below the emergency threshold of___.

1°C [ ]	1, 5°C [ ]	Others:
2°C [ ]	2, 5°C [ ]	
3°C [ ]	3, 5°C [ ]	

2.2 CO2 equivalent (CO2e) – Concentration

To stabilise the greenhouse gas (GHG) concentration and to secure not to exceed the emergency threshold of the global mean temperature, the maximum concentration of CO2e should constitute ___ parts per million by volume (ppmv).

400 ppmv [ ]	450 ppmv [ ]	Others:
500 ppmv [ ]	550 ppmv [ ]	
600 ppmv [ ]	650 ppmv [ ]	

2.3 CO2 equivalent (CO2e) – Emission per Capita

Nicholas Stern (IG Patel Professor of Economics and Government (LSE London) and Chair of the Grantham Research Institute) proposes and claims a world average CO2e emission per capita of 2 tonnes per capita by 2050.

The world average CO2e emission per capita by 2050 should not exceed ___ tonnes per capita.

1 [ ]	1.5 [ ]	Others:
2 [ ]	2.5 [ ]	
3 [ ]	3.5 [ ]	

3. UNFCCC COP15 IN COPENHAGEN (DECEMBER 2009)

3.1 DEVELOPED COUNTRIES (ANNEX – I COUNTRIES)

3.1.1 Outcome of COP15

Industrialised countries (Annex-I countries) should aspire at least the following outcome of COP15 for the period after 2012 (end of Kyoto Protocol commitment):

Framework [ ]
"UN COP 15.5 in spring 2010" [ ]
Binding Treaty [ ]
Other:

The COP15 outcome should at least include:

A future climate action framework by 2020 [ ]
A future climate action framework by 2050 [ ]
Concrete emission targets by 2020 [ ]
Concrete emission targets by 2050 [ ]
"UN COP15.5" aim and action plan [ ]
Magnification of Emission Trade Systems [ ]
Minimal Guaranteed Financial Flow (CDM) to Non-Annex I Countries [ ]
Covenant for Developing Fund (in addition to World Bank Programmes) [ ]

3.1.2 CO2 equivalent (CO2e) – Emission Reduction Target (by 2020)

Industrialised Countries (Annex-I Countries) should reduce their CO2e emissions by ___ (%) until 2020 (related to the level of 1990):

10% [ ] 15% [ ] 20% [ ] 25% [ ]
30% [ ] 35% [ ] 40% [ ] 45% [ ]
Others:

3.1.3 CO2 equivalent (CO2e) – Emission Reduction Target (by2050)

Industrialised Countries (Annex-I Countries) should reduce their CO2e emissions by ___ (%) until 2050 (related to the level of 1990):

50% [ ] 55% [ ] 60% [ ] 65% [ ]
70% [ ] 75% [ ] 80% [ ] 85% [ ]
90% [ ] 95% [ ] 100% [ ] Others:

3.2 USA

3.2.1 Obama's Participation

The personal participation of U.S. President Barack Obama on COP15 is

Very important	[ ]
Important	[ ]
Relevant	[ ]
Less Relevant	[ ]
Unimportant	[ ]

3.2.2 U.S. Climate Act "*The Cap and Trade Bill HR 2454*"

If the U.S. Climate Act "The Cap and Trade Bill HR 2454" (which introduces a carbon trading system and includes binding national emission reductions of 20% by 2020) will be passed in advance of COP15, the change for a successful outcome of COP15…

[ ] will be higher, because it represents an ambitious target and signal to the COP15.
[ ] will not change, because the USA is still the biggest GHG emitting country.
[ ] will be lower, because the target is not ambitious enough.
[ ] will be lower, because especially developing countries have (in relation) more ambitions targets.

3.3 DEVELOPING COUNTRIES (NON- ANNEX-I COUNTRIES)

3.3.1 Outcome of COP15:

By 2020: Developing countries (Non-Annex I countries) should…

focus on developing performance	[ ]
focus on domestic interests (increase of GDP e.g.)	[ ]
focus on presenting a framework with binding goals…	
… now	[ ]
…until 2015	[ ]
…until 2020	[ ]

Others:

By 2050: Should the developing countries (Non-Annex I countries) obligate themselves to make substantial emission cuts?

[ ] Yes, independent from the outcome of COP15 negotiations and the binding goals of Annex-I countries

[ ] Yes, but not until Annex-I countries have obligated themselves for substantial emission cuts and presented a binding document

[ ] No, Non-Annex-I countries should focus on domestic development

3.4 LEAST DEVELOPED COUNTRIES

Should Least Developed Countries (LDCs) be taken out of emission reduction targets?

[ ] Yes, at least until 2020
[ ] Yes, until 2050
[ ] No
Others:

4. CLEAN DEVELOPMENT MECHANISM (CDM)

4.1 CDM in General

CDM represents the only instrument to achieve emission reduction targets [ ]
CDM represents an effective instrument to reduce GHG emissions [ ]
CDM has a huge economic potential [ ]
CDM increases the economic dependence of developing on industrialised countries [ ]
CDM could be effective but the current trading legislation is useless [ ]
CDM is “green-washing” of national eco-assessments [ ]
Others:

4.2 Markets

The main financial power of (a) prospective carbon trading period(s) from 2013 (based on COP15 negotiations) should be focussed on

Current Institutions and Organisations [ ]
New Designed Carbon Markets [ ]
Additional Institutes / Markets [ ]
Others:

4.3 Carbon Trading Systems

The following Carbon Trading System represents the most effective and sustainable instrument:

“Emission Trading” / “Cap and Trade” [ ]
“Project-Based Credits” / “Offset” [ ]
“Hybrid Trading Systems” [ ]
Others:

4.4 Necessary Financial Flow to Developing Countries by 2020

To secure a technical development of developing countries the following amount of annual financial flow by 2020 (based on carbon trading) to developing countries is needed:

<20 billion US$ [ ] 20-30 billion US$ [ ]
30-40 billion US$ [ ] 40-50 billion US$ [ ]
50-60 billion US$ [ ] more [ ]

4.5 Necessary Financial Flow to Developing Countries by 2030

To secure a technical development of developing countries the following amount of annual financial flow by 200 (based on carbon trading) to developing countries is needed:

<30 billion US$ [ ]	30-45 billion US$ [ ]
45-60 billion US$ [ ]	60-75 billion US$ [ ]
75-90 billion US$ [ ]	more [ ]

5. Carbon Capture and Storage (CSS)

Carbon Capture and Storage CSS represents

[ ] a technical solution to reduce the GHG emissions and secure the energy supply
[ ] one of many green ideas, which still has to be researched
[ ] a wrong thinking on the way to a low-carbon society

If you want, you can state your position to Climate Change, Emission Trade and / or CCS or give additional information:

THANK YOU!!!